

EMERGENCY RESPONSE OPERATIONS & MAINTENANCE MANUAL



SPARTAN MOTORS USA, INC. (Spartan)

OPERATION AND MAINTENANCE MANUAL for CUSTOM EMERGENCY RESPONSE CAB & CHASSIS MODELS

Every effort has been made to ensure accuracy
and quality in publication of this document.
At the time of printing, content is the
most current available.

Due to technological advancements, continuous improvement
of our products and the products of our component suppliers,
Spartan Motors USA, Inc. reserves the right to change
specifications without notification.

Spartan Motors USA, Inc.
1541 Reynolds Rd.
Charlotte, MI 48813
USA
1-517-543-6400

www.spartaner.com

Dear Valued Spartan Owner:

Everyone at Spartan Motors USA, Inc. would like to express our sincere thanks for your confidence in purchasing an emergency vehicle featuring our custom engineered and manufactured cab and chassis.

This manual describes the proper use and care of your cab and chassis, which will help assure years of safe and trouble free operation. Before operating the vehicle, the owners and operators should have a thorough understanding of vehicle operation and maintenance.

Once again, "Thank You" for selecting a premium emergency vehicle featuring a world class custom product manufactured by Spartan Motors USA, Inc. If at any time you have questions pertaining to your cab and chassis, please contact the Spartan Customer & Product Support at 1-800-543-5008 Option #1 for Warranty (vehicles delivered to the end user) or Option 4 OEM/Dealer technical service (truck not yet delivered to the end user).

The fax number for our Emergency Response (ER) Warranty Parts Department is 517-543-9264.

The fax number for our Emergency Response (ER) Non-Warranty Parts Department is 517-543-9979.

Sincerely,
Spartan Motors USA, Inc.



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Not all information contained in this manual may pertain to your vehicle. If you have any questions about the operation of your cab & chassis or the manual, please contact Spartan Motors USA, Inc. Customer & Product Support: 1-800-543-5008 Option #1.

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1.0 INTRODUCTION



SAFETY ALERTS

Safety alerts are presented in this manual with the following symbols describing the safety risks and potential outcome for each type of alert.

CAUTION

This symbol is used to address practices not related to personal injury.



A hazardous condition exists that may result in minor to moderate injury, property damage or destruction if instructions are not strictly observed.



A potentially hazardous condition exists that may result in death or serious injury, property damage, or destruction if instructions are not strictly observed.

NOTICE

This symbol is used to address practices not related to physical injury.

CHASSIS / BODY INTERFACE

As a custom manufacturer of cab and chassis products, Spartan is committed to providing a high quality product to our customers. Spartan works closely with the Final Stage Manufacturers to ensure system integrity is preserved and the retail purchaser is presented with a quality product. It is important to understand that not all information in this manual will apply to every unit manufactured since some features are optional.

Refer to the appropriate Final Stage Manufacturer's literature for additional information. Guidelines for Body interface requirements are provided to our Final Stage Manufacturer's as published in the Emergency Response Apparatus Builders Manual.

MAINTENANCE RECORDS

It is the owner's responsibility to keep accurate maintenance and repair records, including receipts. Should the lack of required maintenance be the reason for repair, a warranty claim will not be accepted. Spartan reserves the right to request your maintenance and repair records for verification of compliance with required maintenance practices and intervals.

Spartan recommends maintenance and repair records/receipts be maintained as permanent records and kept in a secure location. Acceptable records include itemized bills, dealer work orders, owner's vehicle log, and service facility receipts, which **must** state the date service was performed Vehicle Identification Number (VIN), mileage (kilometers), engine hours, and service performed.

CAUTION

Through out this manual the term "routinely" is used to describe certain maintenance intervals. Routine maintenance interval may be dependent on vehicle usage, for such recommended activities the user shall define intervals.

REPORTING SAFETY DEFECTS

If you believe that your vehicle has a defect, which could cause a crash, injury, or death, you should immediately advise Spartan Customer & Product Support, the National Highway Traffic Safety Administration (NHTSA), Transport Canada, and/or Environmental Protection Agency.

NHTSA cannot become involved with individual issues between the customer and the dealer or any subsidiary. However, if NHTSA receives similar complaints, an investigation may be opened to study the possibility of a safety defect that may exist in a group of vehicles. Should a defect be confirmed, a recall or remedy campaign may be ordered.

To contact NHTSA, call the Auto Safety Hotline toll free at 1-888-327-4236, write to:
U.S. Department of Transportation,
National Highway Traffic Safety Administration,
Office of Defects Investigation,
NVS-216, 1200 New Jersey Avenue, SE
Washington, DC 20590 or to file a complaint online: <http://www-odi.nhtsa.dot.gov/ivoq/>

Defect Investigations and Recalls | Enquêtes sur les défauts et rappels
Transport Canada - Road Safety, 80 rue Noël, Gatineau, (Quebec) J8Z 0A1
Transports Canada - Sécurité routière, 80 rue Noël, Gatineau, (Quebec) J8Z 0A1
Government of Canada | Gouvernement du Canada
Telephone | téléphone Sans frais | Toll Free 1-800-333-0510

To contact Environmental Protection Agency:
Director Field Operations and Support Division
Environmental Protection Agency
401 “M” Street SW., Washington, DC 204620
Attention: Warranty Claim

VEHICLE DATA RECORDER (VDR) SYSTEMS

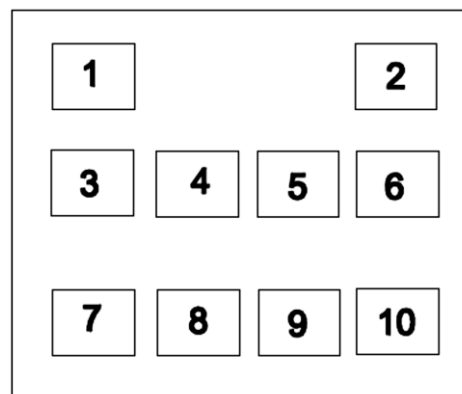
Your vehicle may be equipped with a Vehicle Data Recorder (VDR) System. The VDR records information including, but not limited to, the following information:

- | | |
|---|--|
| • Maximum vehicle speed | MPH |
| • Maximum acceleration (from speedometer) | MPH/Sec |
| • Maximum deceleration (from speedometer) | MPH/Sec |
| • Maximum engine speed | RPM |
| • Maximum engine throttle position | Percentage of full throttle |
| • ABS Event | On/Off |
| • Seat occupied with seat belt unbuckle | Yes/No by position at 30 seconds into minute |
| • Master Optical Warning Device Switch | On/Off at 30 seconds into minute |
| • Time | 24 hour time |
| • Date | Year/Month/Day |

To access data stored in the VDR, electronic equipment is necessary. Software is available for your access to this system. For more information, contact Spartan Customer & Product Support.

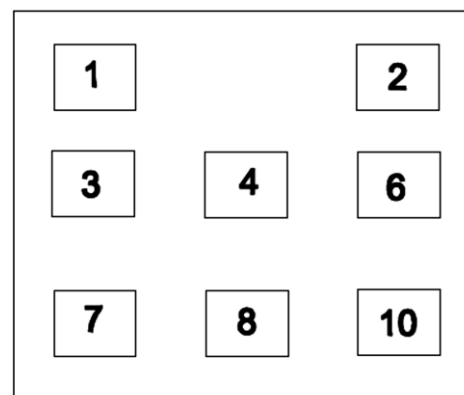
This is the traditional seating arrangement; if you have missing seats from this configuration the seat number will still remain (e.g. if you are missing seats 4 and 5 the seat behind the officer will still be seat 6.)

FRONT OF CAB



This is a modified seating arrangement; this is used when a center seat is installed. If you are missing seats from this configuration, the seat number will remain. If you are missing seats and you have a center seating arraignment along the back wall then those seats will remain seats 7, 8, and 10.

FRONT OF CAB



2.0 GENERAL INFORMATION



VEHICLE IDENTIFICATION NUMBER

When filing a warranty claim, submitting a complaint, or general inquiries, you will need to provide the last eight digits of the vehicle identification number (VIN) as stated on the label.

If you have a question regarding your chassis, or this manual, please contact the Spartan Customer & Product Support at 1-800-543-5008 option 1.

CHASSIS WARRANTY AND REGISTRATION

The prompt return of the Limited Warranty Registration in the front of this manual will allow servicing of the chassis under warranty, should a warrantable condition exist. The most effective way to submit our Chassis Registration Form is through our website, www.spartaner.com, under the customer & product support tab. If a computer is not available, complete the paper form and mail to the address below.

Spartan Motors USA, Inc.
Customer & Product Support
1541 Reynolds Rd.
Charlotte, MI. 48813

THE CHASSIS LIMITED WARRANTY IS NOT VALID, AND REMAINS NULL AND VOID, IF THE LIMITED WARRANTY REGISTRATION FORM IS NOT RETURNED WITHIN (30) DAYS AFTER THE DATE OF RETAIL PURCHASE. IF YOU ARE NOT SURE WHETHER YOUR WARRANTY IS STILL IN EFFECT, OR HAVE OTHER QUESTIONS ABOUT WARRANTY COVERAGE, PLEASE CONTACT THE SPARTAN CUSTOMER & PRODUCT SUPPORT AT 1-800-543-5008 OPTION 1.

LIMITED WARRANTY COVERS

The limited warranty covers repair or replacement, at the sole option of Spartan Motors USA, Inc. (hereinafter Spartan), of any part of your new Spartan chassis (hereinafter Covered Parts) in which a defect in materials or workmanship appears during normal use, maintenance or service within the limited warranty period, subject to certain limitations and exclusions described in the limited warranty. REPAIR OR REPLACEMENT OF COVERED PARTS BY A SPARTAN AUTHORIZED SERVICE CENTER IS THE EXCLUSIVE REMEDY UNDER THE LIMITED WARRANTY. SPARTAN WILL NOT REPLACE THE FIRE TRUCK OR REPURCHASE THE FIRE TRUCK FROM YOU. The repair or replacement of a Covered Part does not extend the life of the limited warranty except where state or provincial law otherwise provides for an extension during the time that the Covered Part is being repaired or replaced under the limited warranty. Covered Parts are limited to chassis systems and components such as the driveline, cooling system, hydraulic system, suspension, air system, and climate control system. The frame, cab structure, and paint are each covered by specific warranty terms as defined in their individual warranties. The chassis limited warranty excludes the engine, certain emissions components, and transmission or any parts or components added to the chassis by another party. In addition to the Spartan limited warranty, original component manufacturers may provide their own warranties. Owners should check the original component manufacturer's warranty regarding its coverage. The limited warranty is valid only in the United States and Canada. **For more detailed information, refer to the warranty section of this manual.**

Certain components of the emissions control system have a 5 year/100,000 mile warranty, whichever comes first. Contact Spartan if you have questions regarding this warranty.

For model year 2014 and later vehicles, tires will have a warranty of 2 years/24,000 miles whichever comes first. Contact Spartan if you have questions regarding tire related warranty.

GROSS VEHICLE WEIGHT RATING (GVWR)

The GVWR is the **rating** established by Spartan as the maximum weight of the vehicle (including cargo, passengers, liquids, etc.), or the load carrying capacity, that the components of the vehicle are designed to support. This rating excludes any towed item.

GROSS COMBINATION WEIGHT RATING (GCWR)

Gross Combination Weight Rating – A value specified by the manufacturer of the power unit, if such value is displayed on the Federal Motor Vehicle Safety Standard (FMVSS) certification label required by the National Highway Traffic Safety Administration, or

The sum of the gross vehicle weight ratings (GVWRs) or the gross vehicle weights (GVWs) of the power unit and the towed unit(s), or any combination thereof that produces the highest value.

GROSS AXLE WEIGHT RATING (GAWR)

The GAWR is the maximum weight **rating** that an axle assembly is designed to support, the load-carrying capacity. Axle assembly components include the axle, suspension, tires, wheels, and brakes. Weight distribution on an axle **must** be as equal side-to-side as possible to avoid overloading one side. Therefore, individual wheel position weights **must** be taken to avoid this condition. If one side is overloaded by more than 5% of the total axle rating (GAWR), it is necessary to redistribute the load appropriately. For example, if the GAWR of one axle on your vehicle is 10,000 pounds, 5% of that is 500 pounds. This means that the actual weight difference between the left and right side of the axle **must** be within 500 pounds. In addition, the actual weight on one side of a single axle **must** never exceed 50% or 1 half of the GAWR for that axle, which would be 5000 pounds for the preceding example. Refer to the axle manufacturer's literature for additional information.

3.0 CAB



FINISH CARE RECOMMENDATION

Spartan recommends that the following precautions be followed to ensure proper care of the finish on your new vehicle. If these recommendations are not followed, your paint warranty may be null and void.

The first 30 days...

- Avoid parking under trees – sap and bird dropping may damage the new finish. (Rinse them off as soon as possible)
- Avoid driving on gravel roads – rock chips may occur on the fresh new finish.
- **Do not** let gasoline, diesel fuel, antifreeze, transmission fluid, diesel exhaust fluid, or windshield washer fluid stand on painted surface. Rinse them off as soon as possible. **Do not wipe.**

The first 90 days...

- **Do not** wax or polish the vehicle – this will allow the finish to dry and harden completely. **Do not** use any silicone-containing waxes or polishes.
- After 90 days, the vehicle **should** be polished with a premium quality product.
 - Consult the following manufactures for their recommendations.
 - 3M™
 - Meguiars®
- **Do not** use chalk or crayon on glass or painted cab surfaces.

Long term care...

- Never use ice scraper to remove ice or snow – this will cause scratches to the finish.
- Never use abrasive cleaner, chemicals, steel wool or scuff pads directly on the finish - this will cause damage to the finish.
- Remove road salt immediately by washing and rinsing vehicle with clean water
- Rinse entire unit, including undercarriage
- Remove road tar by washing followed by a quality wax and grease remover or tar remover and a clean cotton cloth. Wipe off excess cleaner ASAP.

NOTE: If your finish is PPG - PPG recommends finger nail polish remover or lighter fluid to remove road tar.

Proper washing recommendations...

- **Do not** use commercial car wash. Stiff brushes could mar the finish and damage the surface. Wash vehicle by hand with cold water and a very mild dish wash soap. Be sure to use a soft cloth or sponge.
- Wash the vehicle in shade – never in direct sun.
- Allow to air dry or wipe dry using clean cotton rags.
- **Do not** “dry wipe” the vehicle – Always use clean cool water. Dry wiping could scratch the finish.

NOTE: If your finish is PPG - PPG recommends if vehicle is washed indoors, vehicle MUST BE thoroughly air-dried.

Proper add-ons recommendations...

- If any mounting of additional equipment (light, handles, etc.) are needed use the following steps.
 - Mount equipment with adhesive compounds or two-sided tape (consult your local 3M™ distributor) when at all possible – this will keep the finish intact and not damage it.

- If drilling is required, mark holes to be drilled using a marker. Drill holes using a sharp drill bit. After drilling, remove **ALL** metal shavings. Prior to mounting equipment, apply LOCTITE® C5-A® compound or an equivalent product to all screws. This will prevent corrosion of any metal and helps keep paint from blistering from metal electrolysis.

NOTE: If your finish is PPG - PPG recommends applying a compound (ECK® Electrolysis Corrosion control or Dolphin) to all screws.

ADVANCED PROTECTION SYSTEM (APS) (IF EQUIPPED)

To determine if the vehicle is equipped with APS, look for the Advanced Protection System badge on the steering wheel. When the vehicle is started, a prove out sequence will last for approximately eight seconds. After this “prove out” period, the LCD message and telltale should no longer be illuminated. If this prove out sequence does not occur, the SRS telltale remains illuminated (continues to flash), or the LCD message remains active, the APS may not be fully functioning and the APS should be serviced as soon as possible.



Operating the vehicle when the APS system is not fully functioning, may result in personal injury.

The APS contains inflatable air bags located throughout the cab, belt pretension devices (used to tighten seatbelt systems), and outboard sensors at the perimeter of the cab. Restraint Control Modules for the system are located under the dash on the officer side. Accessory installation on, or near, the area of the officer side dash **must** be done in such a way that the RCM remains accessible using basic hand tool by one person within approximately thirty minutes. **This area must be kept free from fluids.**

Once vehicle electrical power has been removed, wait five seconds prior to beginning service. If the SRS light is on (refer to control panel layout for location of SRS light) then contact Spartan Customer & Product Support Group.



All occupants, including the driver, must wear their seat belts whether or not an air bag is provided at their seating position to minimize the risk of severe injury or death in the event of a crash.



DO NOT install additional wiring or loosen this grounding terminal. Compromising this connection could disrupt the Spartan Advanced Protection System resulting in personal injury or equipment damage.



OFFICER SIDE INTERIOR PICTURE

OFFICER SIDE EXTERIOR PICTURE

SERVICING COMPONENTS

Servicing of the APS components must be performed by authorized personnel only.



When servicing components of the APS (including pyrotechnic devices, and sensing devices); vehicle electrical power must be disconnected prior to removal of connections or probing of pins. During service, if probing of pins is required, to reduce the probability of Electrostatic Shock Damage (ESD), ensure correct grounding of service personnel before probing pins, with either a tether or ground mat. Otherwise, if pins are not to be serviced/touched, place caps over the disconnected connectors until the harness can be reconnected. Failure to do so may cause inadvertent air bag deployments which could result in personal injury or death.

Refer to FIG. 3-1 and 3-2, which show a seat pretensioner interface connection and driver air bag interface connection, before beginning work on any components of the APS. Disconnect vehicle power then, disconnect at each location. Vehicle power **must** remain disconnected prior to connecting the interfaces points, once all connections have been made vehicle power may be restored.

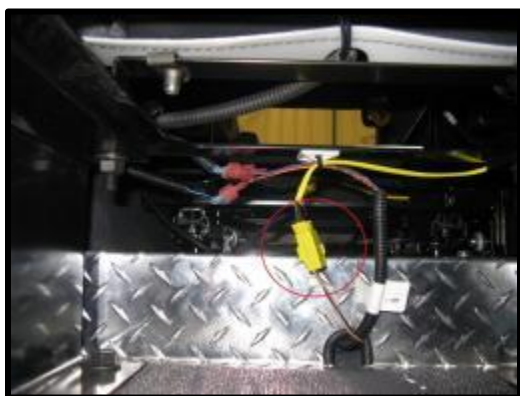


FIG. 3-1



FIG. 3-2

APS HANDLING DO'S AND DON'T

DO'S

- Always consider the device to be live and dangerous.
- If not certain the device is live or spent, it **must** be treated as if it is live.
- Always refer to the applicable supplier information about live devices.
- Wear the proper personal protective equipment.
- **Must** read any and all caution and warning labels on the device and abide by the instructions.
- When carrying a live air bag module, hold it with the cover pointed away from the body.
- When placing a live air bag module on any surface always place it with the cover pointed up.
- When handling a pre-tensioning seatbelt buckle assembly, hold it by the round piston tube with the end of the tube farthest from the buckle pointed away from yourself and any other person.
- When handling a pre-tensioning seatbelt retractor assembly, hold it by the protruding piston tube on the side of the retractor, or by gripping the two sides together and point the end of the tube away from yourself and any other person.

DON'TS

- **Do not** tamper with any live device.
- **Do not** attempt to take apart or diagnose any problems.
- **Do not** hammer, drill, cut, or weld on any live device.
- **Do not** apply electrical current to the device on any manner.
- **Do not** use a Volt-Ohm Meter on any live device. This **must** only be done by trained personnel.
- **Do not** subject a live module to extreme heat or open flame.
- **Do not** carry a live device by the electrical wires.
- **Do not** drop or throw a live device.
- **Do not** immerse in water.
- **Do not** place any objects on top of the air bag module cover.
- **Do not** set an air bag module down on its cover; the cover **must** be pointed up.
- **Do not** point the exit of the piston tube of a pre-tensioning seatbelt assembly towards anyone.
- **Do not** put any objects into the piston tube of a pre-tensioning seatbelt assembly.

STORAGE

Storage **must** always be done in accordance with any federal, state, and local regulations. Local regulations **must** include local building and fire codes.

Always store a live air bag module in its approved shipping container when available. Store in a cool, dry, secure area away from all corrosives, oxidizers, ignition sources, or high heat sources. Curtain type air bags **shall** be stored lying as flat as possible and unfolded. Air bag modules **must** be stored with the cover facing up not down.

SHIPPING

Pyrotechnic devices are considered hazardous materials for shipping by the U.S. Department of Transportation. Approved packaging with correct hazardous material identification and documents **must** be completed when shipping.

AIR BAG DEPLOYMENT KEEP OUT ZONES

Your vehicle may be equipped with Spartan's APS (Advanced Protection System). This system includes multiple air bags. In order to ensure correct and uninhibited deployment, air bag deployment zones have been identified and referenced below.

Steering Wheel Air Bag Deployment Zone	Fig. 3-3 and Fig. 3-4
Driver Knee Air Bag Deployment Zone	Fig. 3-5 and Fig. 3-6
Officer Knee Air Bag Deployment Zone	Fig. 3-7 and Fig. 3-8
Driver Side - Side Air Bag Deployment Zone	Fig. 3-9 and Fig. 3-10
Driver Side - Rear / Side Air Bag Deployment Zone	Fig. 3-11 and Fig. 3-12
Officer Side - Side Air Bag Deployment Zone	Fig. 3-13 and Fig. 3-14
Officer Side - Rear / Side Air Bag Deployment Zone	Fig. 3-15 and Fig. 3-16



DO NOT INSTALL ADDITIONAL COMPONENTS IN THE AREAS INDICATED AS AIR BAG DEPLOYMENTS ZONES. SERIOUS PERSONAL INJURY OR DEATH MAY OCCUR.

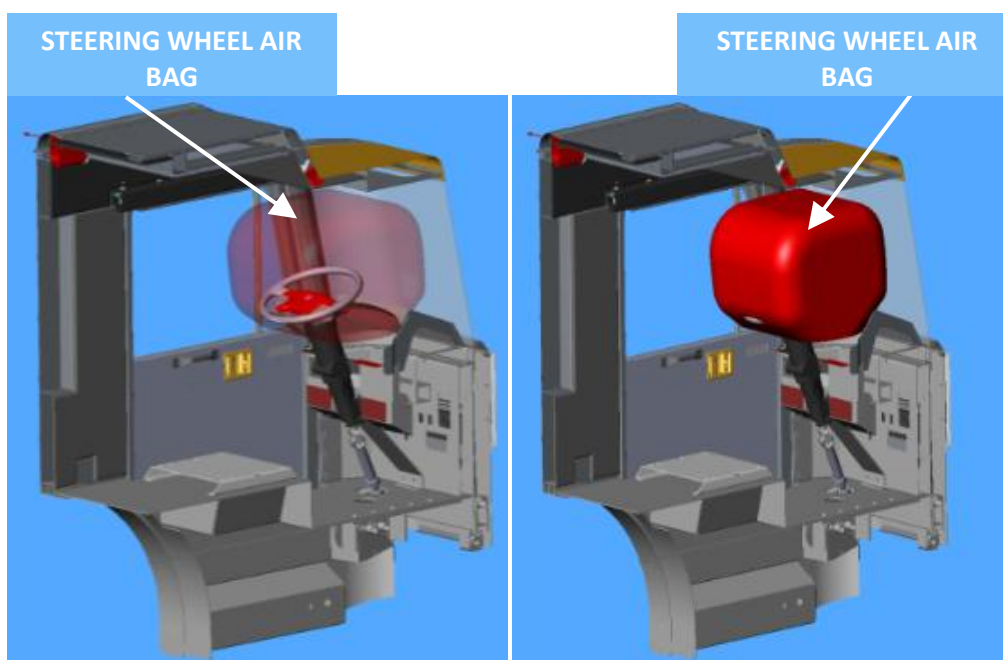


FIG. 3-3
STEERING WHEEL AIR BAG DEPLOYMENT

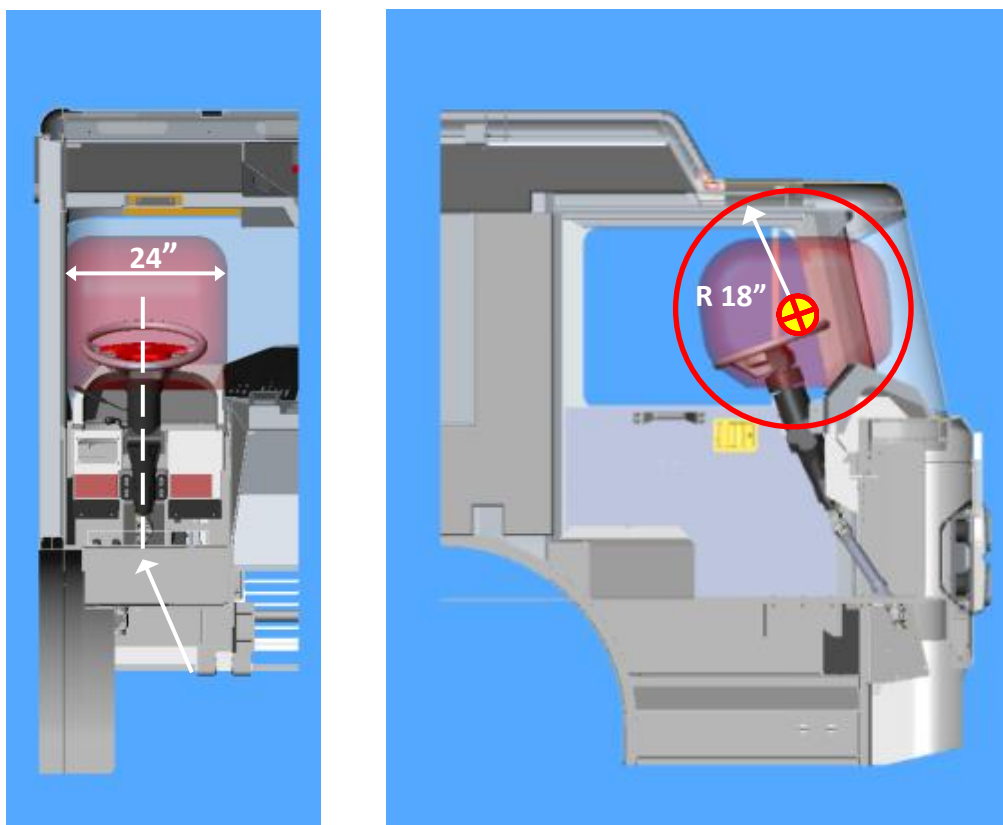


FIG. 3-4
STEERING WHEEL AIR BAG DEPLOYMENT ZONE

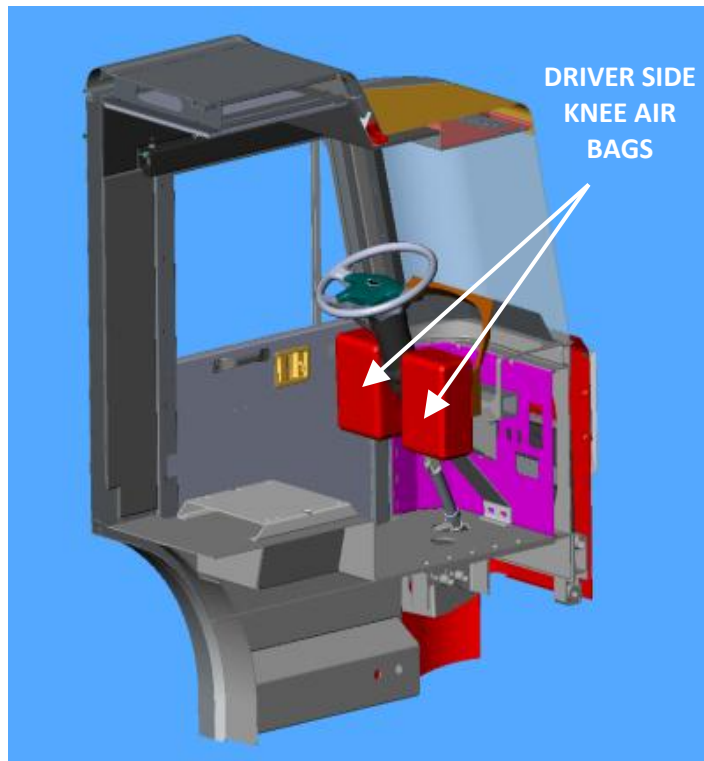


FIG. 3-5
DRIVER SIDE KNEE AIR BAG DEPLOYMENT ZONE

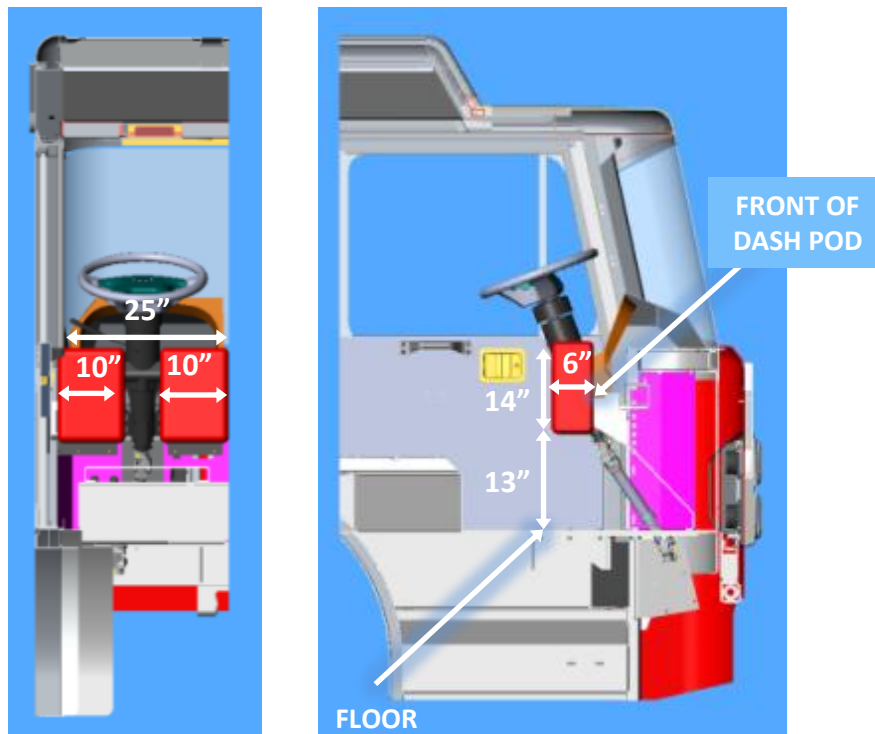


FIG. 3-6
DRIVER SIDE KNEE AIR BAG DEPLOYMENT ZONE



FIG. 3-7
OFFICER SIDE KNEE AIR BAG DEPLOYMENT ZONE

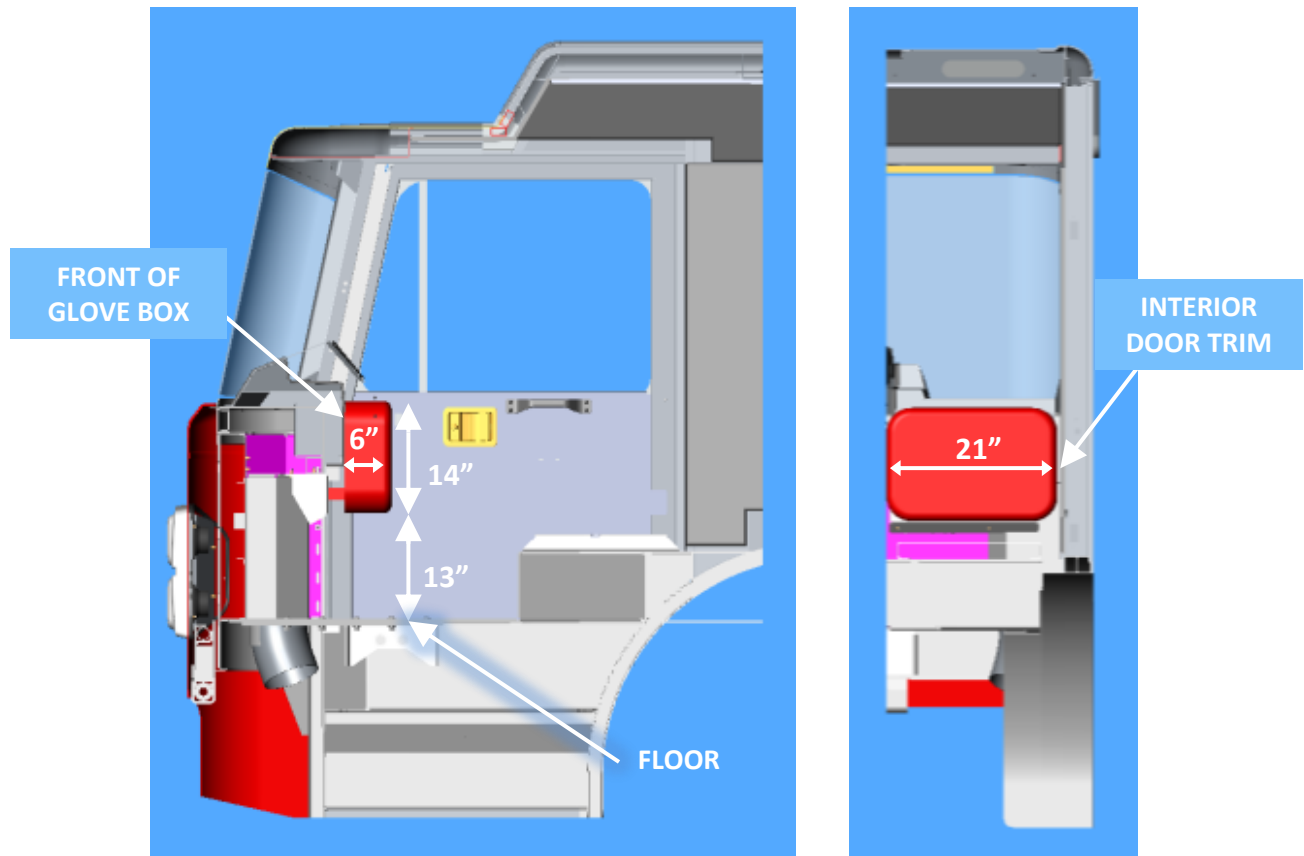


FIG. 3-8
OFFICER SIDE KNEE AIR BAG DEPLOYMENT ZONE

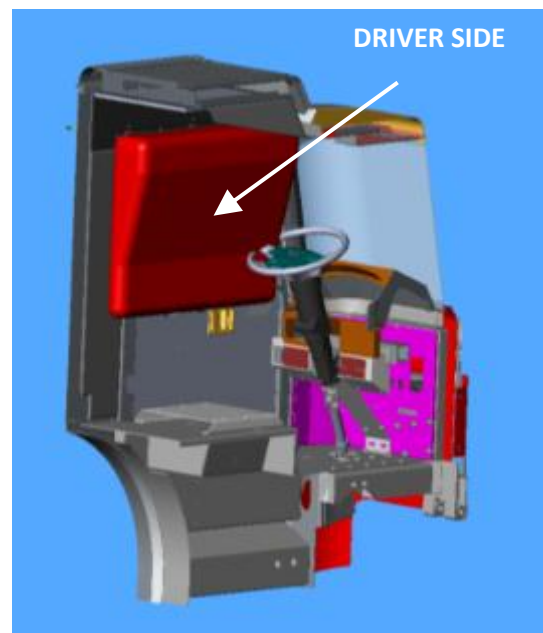


FIG. 3-9
DRIVER SIDE - SIDE AIR BAG DEPLOYMENT ZONE

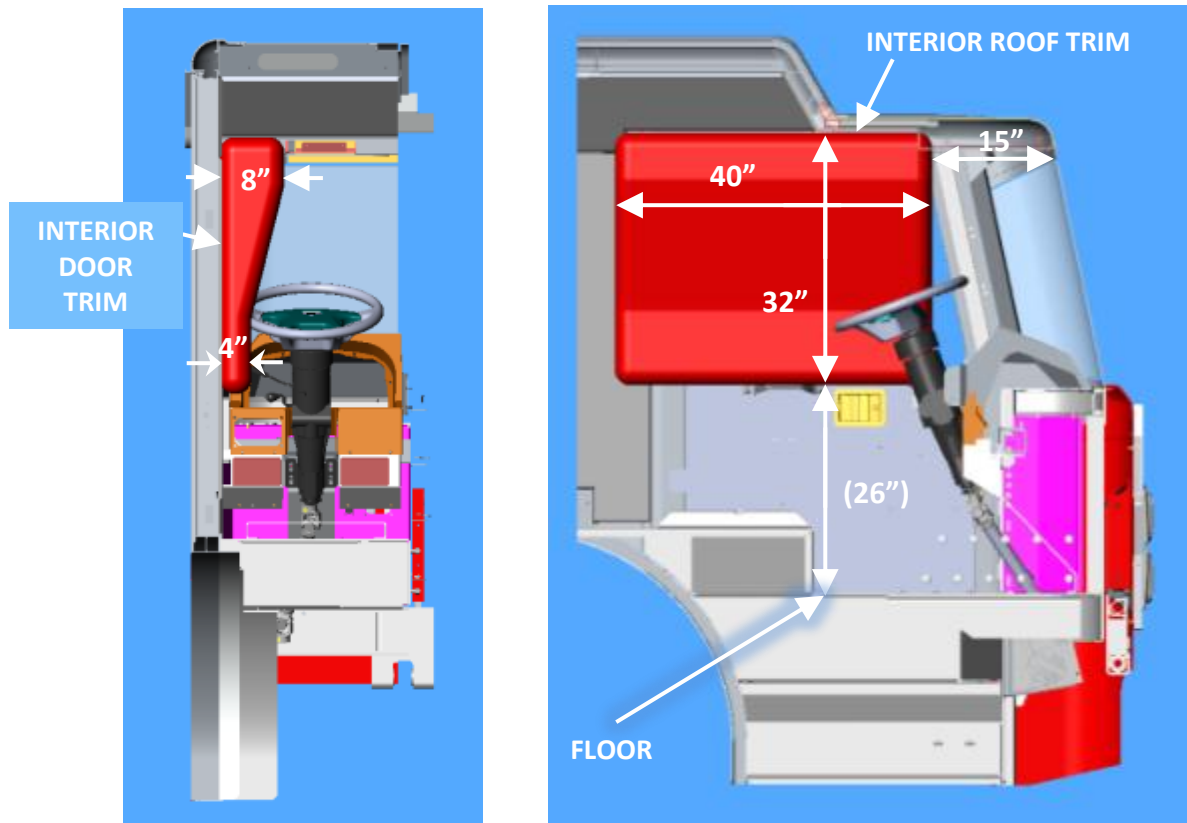


FIG. 3-10
DRIVER SIDE - SIDE AIR BAG DEPLOYMENT ZONE



FIG. 3-11
DRIVER SIDE - REAR-SIDE AIR BAG DEPLOYMENT ZONE

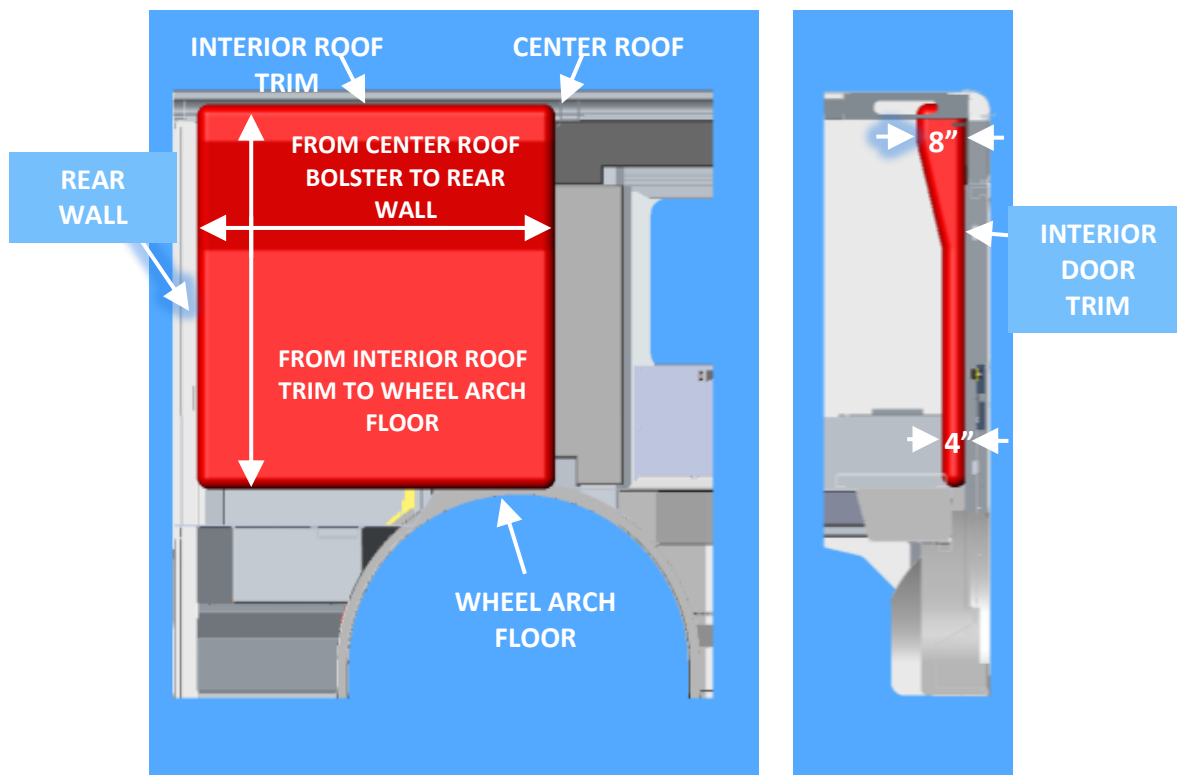


FIG. 3-12
DRIVER SIDE - REAR-SIDE AIR BAG DEPLOYMENT ZONE



FIG. 3-13
OFFICER SIDE - SIDE AIR BAG DEPLOYMENT ZONE

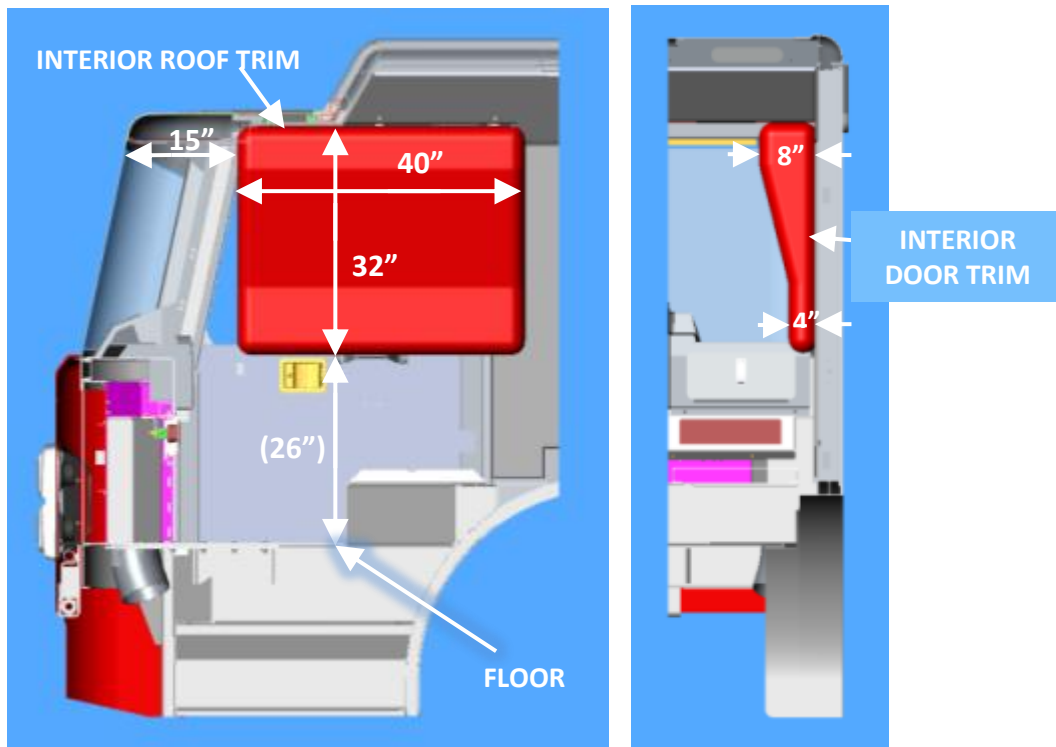


FIG. 3-14
OFFICER SIDE - SIDE AIR BAG DEPLOYMENT ZONE

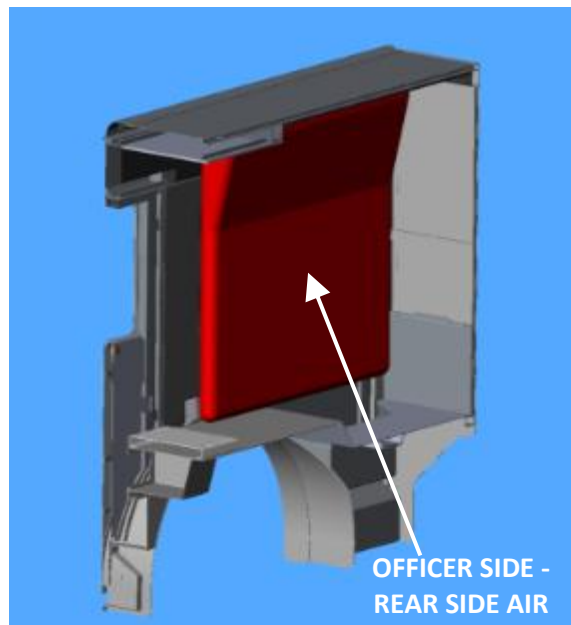


FIG. 3-15
OFFICER SIDE REAR - SIDE AIR BAG DEPLOYMENT ZONE

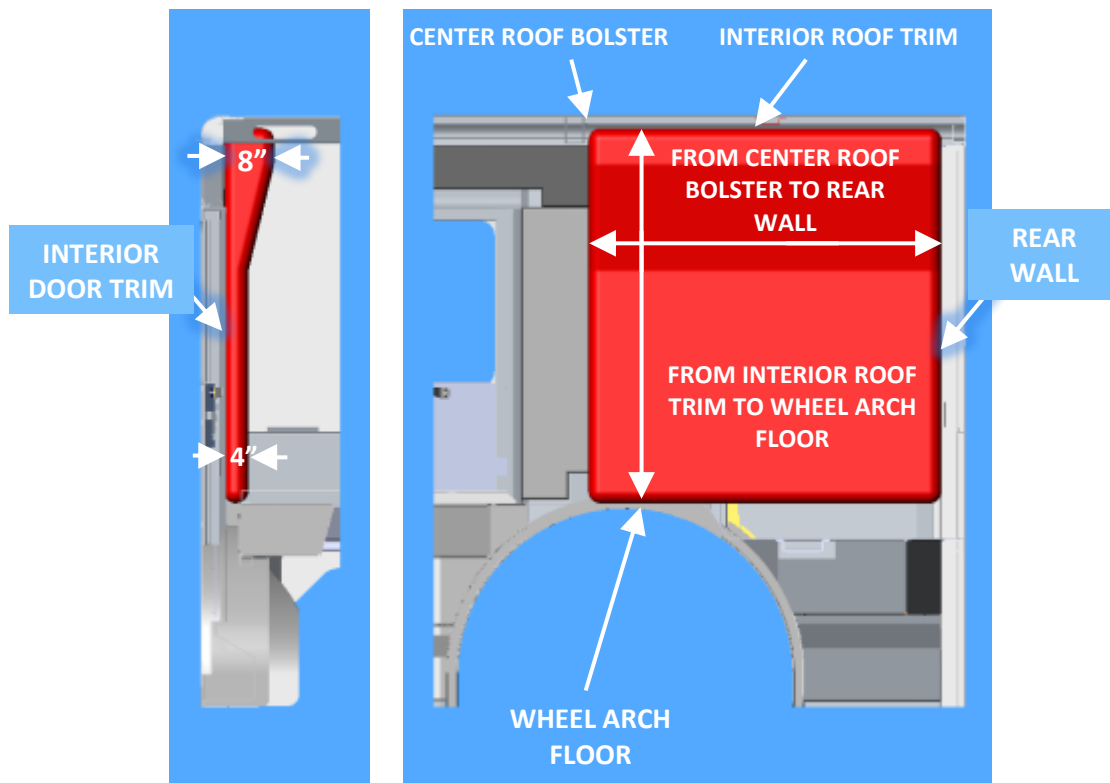


FIG. 3-16
OFFICER SIDE - REAR-SIDE AIR BAG DEPLOYMENT ZONE

AIR BAG MODULES

Your vehicle may be equipped with Spartans APS (Advanced Protection System). This system includes multiple air bag modules. In order to ensure correct and uninhibited deployment, air bag modules have been identified and referenced below.

Refer to Fig. 3-17, Fig. 3-18, and Fig. 3-19 for Air Bag Module Locations.



DO NOT MODIFY OR ALTER THE AIR BAG MODULES. SERIOUS PERSONAL INJURY OR DEATH MAY OCCUR.



DO NOT MODIFY OR ALTER ANY COMPONENTS OR AREAS OF THE VEHICLE IN THE VICINITY OF THE AIR BAG MODULES. SERIOUS PERSONAL INJURY OR DEATH MAY OCCUR.

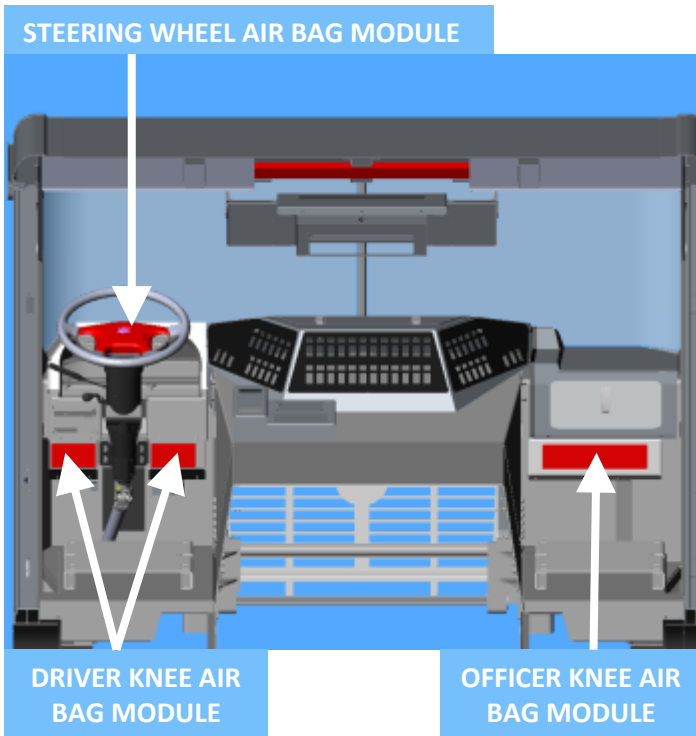


FIG. 3-17
FRONTAL - AIR BAG MODULE LOCATIONS

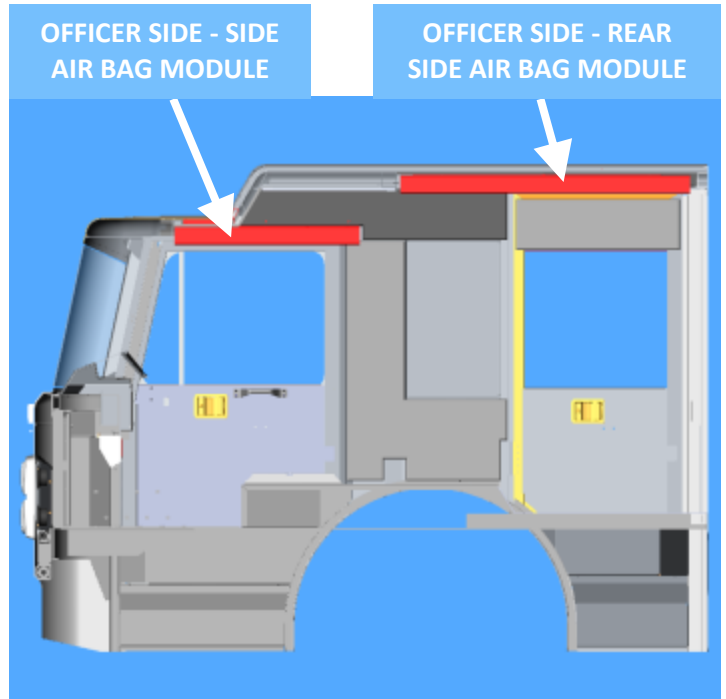


FIG. 3-18
OFFICER SIDE - AIR BAG MODULE LOCATIONS

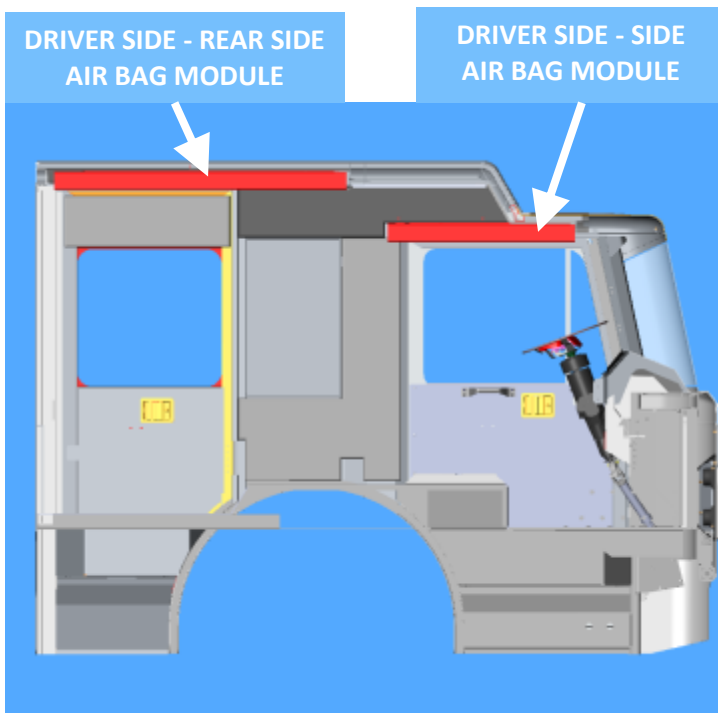


FIG. 3-19
DRIVERS SIDE - AIR BAG MODULE LOCATIONS

OCCUPANCY ROLLOVER PROTECTION (ROLLTEK® SRS) (IF EQUIPPED)

Your vehicle may be equipped with an Occupancy Rollover Protection System. To determine whether your vehicle has this system, there is a Supplemental Restraint System (SRS) (label located above the sun visor). The system contains inflatable air bag's located along the side of the cab, belt pretension devices (used to tighten belt systems) and devices used to pull air seats down (if vehicle is equipped with SRS system).

Control modules for the system are located under the dash on both the officer and driver's side. This area must be kept free from fluids.

If the SRS light is on (refer to control panel layout for location of SRS light) then you are to contact Spartan Customer & Product Support Group.

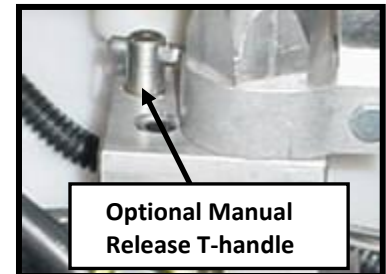
NOTE: The head cushion air bag module, buckle pretensioners, and seat and occupant pretensioning system need to be replaced at 20 years.



MANUAL TILT PUMP DEVICES (IF EQUIPPED)

If equipped, the tilt pump may be operated manually. To lower the cab manually, release the safety support cable and turn the T-handle counter-clockwise using an appropriate device. Ensure cab locks are engaged and turn T-handle clockwise to fully seat. (Cab drifts down if not seated).

If equipped, the jacking rod is mounted on the side of the pump. To raise the cab manually, insert the jacking rod into the jacking device and jack the cab up until the safety support channel clears the right side tilt cylinder housing and automatically engages on top of the cylinder housing against the piston rod. Visually confirm safety engagement.



CAB TILT COMPONENTS

The cab tilt system is comprised of a hydraulic pump that supplies high pressure hydraulic fluid to each of the cab lift cylinders in order to tilt the cab and the mechanical components that allow the cab to pivot and lock down during vehicle operation.



Modifications to the cab tilt system and its components are strictly prohibited. Modifications may result in damage to the chassis or cab, personal injury or death, or void warranty.



Use only Spartan approved replacement hardware and components when servicing the cab tilt system. Failure to do so could result in damage to the chassis or cab, personal injury or death, or void warranty.



When performing maintenance on the cab tilt lift cylinders or attachment brackets and hardware, ensure that the cab is in the full down position and locked. Failure to do so could result in damage to the chassis or cab, personal injury or death. Note: that hydraulic fluid in the system may still be under pressure – use caution when working on fittings or lines.

A cab tilt limit switch option is available which limits the cab travel when tilted. Final adjustment of the limit switch **shall** prevent damage to the cab or any bumper mounted options mounted within the cab travel range.



Limit switch adjustment should **NOT** prevent the engagement of the safety support bar when the cab is in the raised position. Failure to do so could result in damage to the chassis or cab, personal injury or death.

CAB TILT SYSTEM



Before raising or lowering the cab, safety precautions must be taken to avoid personal injury or equipment damage. Ensure frontal and overhead clearance is sufficient to fully raise cab without hitting electrical wires or dangerous overhead objects that could result in serious injury or death.



Ensure headlamps, compartment doors, and the grille, are secured before raising or lowering the cab.

An aluminum cab tilt control instruction plate has been provided with the cab and chassis. The plate **must** be secured in a location close to the storage place of the remote pendant to allow visibility prior to each pendant usage.

CAB TILT PROCEDURE

Remote Electric Cab Tilt Pendant

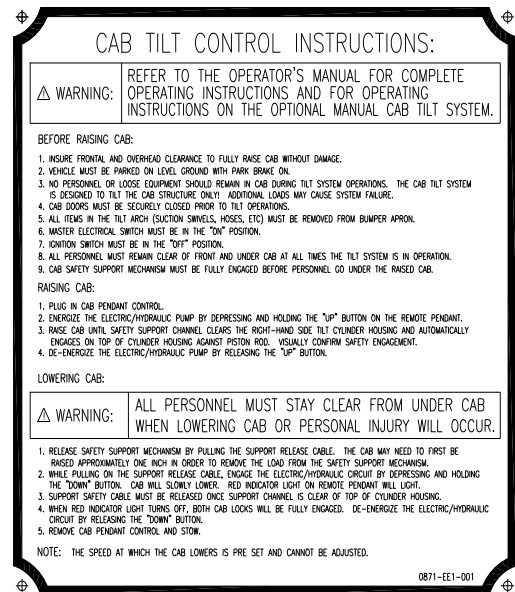
The red light on the pendant will illuminate any time the tilt system is energized by the "D" button until the cab locks have fully engaged.

Before Raising Cab

1. Ensure frontal and overhead clearance to fully raise cab without damage.
2. Vehicle **must** be parked on level surface with park brake on.
3. No personnel or loose equipment should remain in cab during tilt system operations. The cab tilt system is designed to tilt the cab structure only! Additional loads may cause system failure.
4. Cab doors **must** be securely closed prior to tilt operations.
5. All items in the tilt arch (suction swivels, hoses, etc.) **must** be removed from bumper apron.
6. Master switch **must** be in the "ON" position.
7. Ignition switch **must** be in the "OFF" position.
8. All personnel **must** remain clear from front and under cab at all times the tilt system is in operation.

Raising Cab

1. Plug in cab pendant control if not already connected and verify the cab has sufficient clearance to be raised.



2. Energize the electric/hydraulic pump by depressing and holding the "U" button on the remote pendant.



Failure to ensure that the support mechanism is in place may result in personal injury or death.

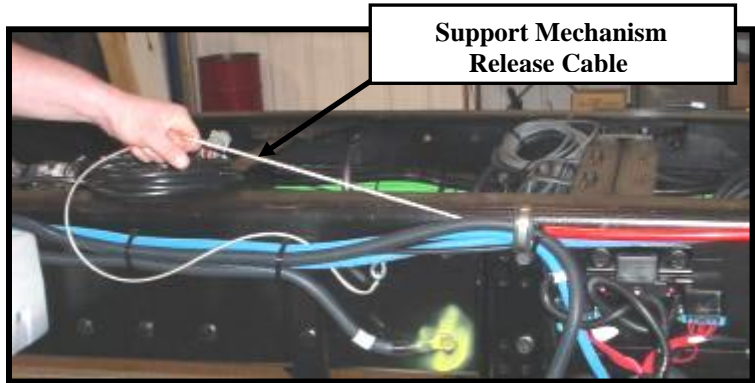
3. Raise cab until support channel clears the right side of the tilt cylinder housing and automatically engages on top of cylinder housing against the piston rod. Visually confirm that support mechanism is fully engaged before personnel go under the raised cab.
4. Deactivate the electric/hydraulic pump by releasing the "U" button.

Lowering Cab



All personnel must stay clear from under cab when lowering cab or serious personal injury or death may occur.

1. Release safety support mechanism by pulling the support release cable. Cab may need to first be raised approximately one inch in order to remove the load from the safety support mechanism.
2. While pulling on the support release cable, activate the electric/ hydraulic circuit by depressing and holding the "D" button. Cab slowly lowers and the red indicator on the remote pendant is illuminated.
3. The red light on the pendant illuminates any time the tilt system is activated by the "D" button, until the cab locks fully engage. The speed at which the cab lowers is pre-set and cannot be adjusted.
4. The support safety cable **must** be released once support channel is clear of top of cylinder housing.
5. When red indicator light turns off, both cab locks will be fully engaged. De-energize the electric/hydraulic circuit by releasing the "D" button.



4.0 VEHICLE ACCESS AND FEATURES



BEFORE GETTING IN CAB

- Ensure Driver's Daily Inspection is complete and approved for service. A Sample Driver's Daily Inspection Form is available at the end of this section. It may be copied and/or altered to accommodate custom usage by the owner / operator. The appropriate fluid **must** be added per the engine and transmission manufacturer recommendations with additional information available on the data tag inside the cab.
- If optional auto ejects are not used, unplug electric and airlines connected to apparatus.
- Ensure that all personnel understand the **3 points** of contact for entering and exiting the cab safely while facing the steps.

BEFORE DRIVING AWAY

- Place master switch in the "on" position; the "battery on" indicator lamp will light.
- Place the ignition switch in the "on" position; the "ignition on" indicator lamp will light.
The instrument gauges and warning buzzers are activated, including accessory items such as the heater. The telltales in the instrument panel briefly illuminate when the ignition is turned on to check lamp function.
- If equipped with an Electronic Fluid Level Checks (EFLC), wait 20-30 seconds before starting the engine. If the oil level "pop-up" comes on, the oil level may be low. Verify oil level by checking level with engine dipstick and fill accordingly.
- Depress engine starter button to crank engine. Release button when engine starts.
- Ensure that all personnel have seat belts fastened.
- Observe door ajar lamp for any open doors or cab tilt lock down (warning indicator is optional) not secured.
- Allow oil and air pressure to build to normal operating range.
- Battery voltage appears on the voltmeter. As a quick check to ensure the charging system is functioning, compare the voltage reading before the engine is started to the reading after it is started. The reading while the truck is running should be higher.
- Adjust driver's seat for pedal position comfort.
- Check mirrors for adjustment.
- Adjust steering wheel telescopic and tilt to a comfortable position.
- Turn head light switch on and lift turn lever for high/low beam to accommodate night driving.
- Ensure headlights are aimed, in accordance with FMVSS 108.
- If conditions require, turn on wipers by depressing lever, toggle lever up for fast and down for intermittent.
- Adjust air conditioner or heater to desired temperature setting.

NOTE: A heater shut-off valve (on non-VMux® trucks only) is located on the right outside rail near the cab pivot point.

- If emergency warning lamps are required, switch on.
- Release park brake.
- Put shift selector into drive and proceed forward.
- Disengage (declutching) the four-wheel drive and tandem interaxle differentials on dry or hard surfaces **only**.

- Fire helmets **shall** not be worn by persons riding in enclosed driving and crew areas. Fire helmets are not designed for crash protection and they will interfere with the protection provided by headrests. The reduction in head clearance creates a greater hazard to personal safety than the helmets will protect.

NORMAL OPERATING RANGE

Some items may have a different specification due to customer requirements.

Idle:	600 – 700 RPM	High Idle:	1250 RPM/Varies with option
Governor:	2100 – 2400 RPM		
Minimum Oil Pressure			
@ Normal Idle:	10 psi (70 kPa)	35 - 45 psi (240 – 310 kPa)	@ 2100 RPM
Cooling System:	180 - 212° F (80 – 95°C)		
Transmission:	160 - 225° F (70 – 95°C)		
Air Pressure:	Cut In: 105 – 110 psi (725 – 758 kPa)		
	Cut Out: 120 – 140 psi (827 – 965 kPa)		
Voltage:	13.2 / 14.0 Volts		

ELECTRIC DOOR LOCK OPERATION (IF EQUIPPED)

Unlocking and locking of entry doors: There are three methods to lock and unlock the cab entry doors.

1. Key Fob- press the entry unlock/lock button.
2. Keypad - enter the code and press the ½ button to unlock, press, and hold the ½ button for 3-4 seconds to lock.
3. Rocker Switch- press the momentary rocker switch in the up or down position.



Unlocking and locking of compartment doors: There are three methods to lock and unlock the compartment doors. These could be on the cab or body.

1. Key Fob- press the compartment unlock/lock button.
2. Key Pad- enter the code and press the ¾ button to unlock, this also unlocks the entry doors. Press and hold the ½ button for 3-4 seconds to lock, this also locks the entry doors.
3. Rocker Switch- press the momentary rocker switch in the up or down position. This switch may be located on the vista screen if the truck is multiplexed and no rocker switch option was chosen.

Setting Key Pad authority and access codes: the authority code is a code that is used to change the access code. The access code is the code that is used frequently to lock and unlock the doors. Typically, the authority code is not shared with others. Only the system integrator (owner or manager) of the vehicle would know the authority code.

Change authority code: This also changes the access code.

The following procedure resets all user codes to undefined values and then allows the system integrator to enter a new authority code, which is also stored as the user 1 access code. This needs to be done for each of the Key Pads.

1. Momentarily ground the learn mode input brown or tan wire located in the cab behind the rocker switches. The buzzer will sound for 3 seconds. Double beeps are provided upon any button press while in learn mode.
2. Enter the desired new authority code. Double “beeps” are provided for each key press. On the fifth key entered, an extra “beep” is played to indicate this step is complete.
Re-enter the 5-digit authority code. The Key Pad will “beep” 4 times after successful confirmation. This assigns the authority code and the user access code.

NOTE: It is recommended that the access code is changed to something other than the authority code.

Change access code:

1. Activate learn mode by pressing and holding the 5/6 key for 5 seconds until the Key Pad “beeps”.
2. Enter the authority code, double beeps are provided after each button press.
3. To indicate successful entry of the authority code an additional beep is played.
4. A continuous beep begins playing to indicate that the user should enter which code to change. Select the code to change ½ user 1 access, ¾ user 2 access code. The continuous beep stops playing. An additional beep indicates successful entry.
5. Enter the new code all five buttons can be used to enter the access code.
6. To indicate successful entry of the new access code, the Key Pad will play and additional beep.
7. Enter the new code again for confirmation. To indicate the code has been programmed successfully the Key Pad will play four continuous beeps.

POWER WINDOWS (IF EQUIPPED)

The power window switch is located on interior door panel of each door. Power windows will only work when the master switch is in the “on” position.



TOWING (IF EQUIPPED)



DO NOT lift, raise, or support the chassis using the tow hooks or eye hooks on the frame. Follow industry safety measures when preparing and towing a vehicle. Failure to do so may lead to personal injury or death.

If a unit **must** be **towed** for any reason, subject to the options available for the vehicle, tow hooks and eyes are **not** to be used for this purpose. Positioning of the lifting and towing device is the sole responsibility of the towing-vehicle operator. A towing device **must** be attached to the frame assembly or axle if allowed by the axle manufacturer.



DO NOT release the parking brakes unless wheels are properly chocked/blocked or vehicle is securely attached to the towing vehicle.

Refer to the appropriate transmission, axle, and suspension manufacturer’s literature for specific towing instructions.

Depending on the reason for towing, the vehicle **must** be properly prepared. Wheels **must** be chocked/blocked, ensure that water is emptied from water tanks (if equipped), and unload any equipment that may cause abnormal load exertion on cab and chassis components.

For towing from the front, refer to the axle manufacturer’s recommended practices. To prevent damage to components, removal of front bumper and other equipment may be necessary.

For towing from the rear, front tires **must** be positioned straight ahead and the steering wheel secured in that position.

CAB DOME LAMPS

There is a clear light above each door, which activates when the door is opened. This same light may be used when the door is closed by pressing the switch on the light housing. The red dome light typically will be switched on manually by the switch.

SEAT CONTROLS

The controls for adjustable seats are located at the front of the seat frame below the cushion. Seat adjustments are activated by a mechanical lever, an air pressure switch, or an electronic switch depending upon the options selected.

The available seat comfort adjustments for fore and aft, raise and lower, back angle adjustment, leg angle adjustment, and lumbar are determined by the ordered option.



Occupants must be seated and seat belts must be securely fastened when vehicle is in motion.

DIAGNOSTIC CENTER

Diagnostics

Diagnostics screens can be accessed when the vehicle speed is equivalent to zero (0) mph, park brake engaged, and the display in the normal operating screen. Available diagnostics are Instrument, Engine, Transmission, and ABS. Refer to the instrumentation user manual for more information.

DOOR AJAR SYSTEM (IF EQUIPPED)

Whenever a cab or compartment door is open and the parking brake is not engaged, a red light flashes to alert of the condition. The light is located overhead between the driver and passenger.

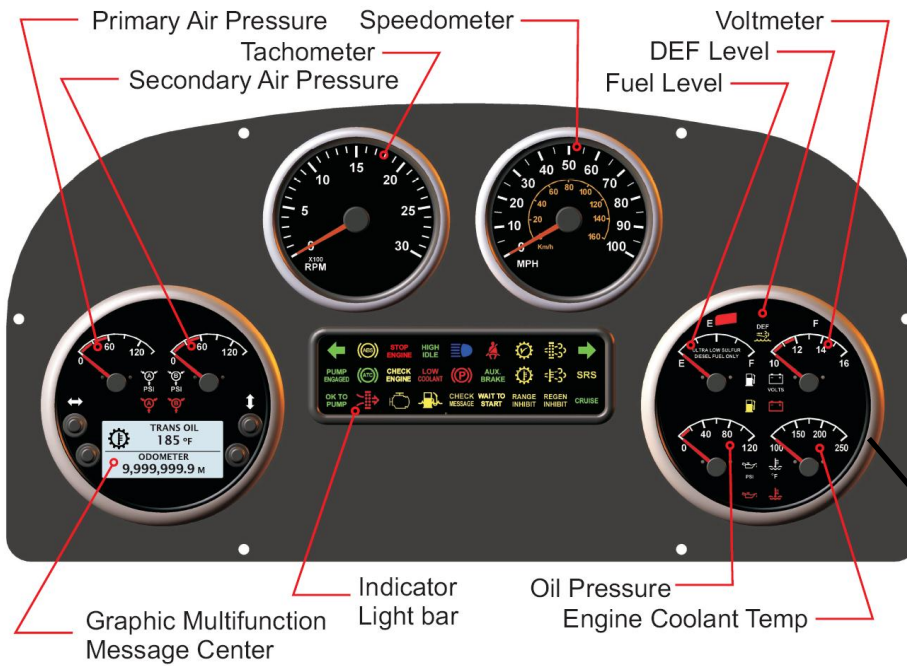


DO NOT MOVE VEHICLE WHEN LIGHT IS ON. If the red Door Ajar light illuminates while driving, the vehicle must be stopped to check for an open door.

5.0 ELECTRICAL



CONTROL PANEL



Instrument Panel



**DEF Indicator
(If equipped)**



For detailed information, refer to the Spartan Instrumentation User's Guide located in the manufacturer's literature.

For detailed information in regarding vehicle emission indicators, refer to the label located above the sun visor.

DIESEL EXHAUST FLUID (IF EQUIPPED)

The chart below explains each of the indicator levels you might see on the DEF indicator.

% of Fluid Needed (Less Than or Equal To)	LED Indication	Message on LCD	Additional Notifications	Audible Alarm (active when DEF trigger is present)
100%				
75%				
50%				
25%				
15%		"LOW DEF"	DEF Lamp-solid on & Amber in color	Audible Alarm becomes active, but it is acknowledgeable.
10%		"ENGINE PERFORMANCE DERATE IMMINENT, LOW DEF"	DEF Lamp-flash on & off at 1 Hz & Amber in color	Audible Alarm becomes active, but it is acknowledgeable
5.0%		"ENGINE PERFORMANCE DERATE ACTIVATED, LOW DEF"***	DEF Lamp-flash on & off at 1 Hz & Amber in color Check Engine Lamp solid on & Amber in color	Audible Alarm becomes active, but it is acknowledgeable
0%		"VEHICLE SPEED RESTRICTION ACTIVATED, DEF REQUIRED"**	DEF Lamp-flash on & off at 1 Hz & Amber in color MIL Lamp solid on & Amber in color & Check Engine Lamp solid on & Amber in color & Stop Engine Lamp solid on & Red in color	Audible Alarm becomes active, but it is acknowledgeable
*Speed Restriction will limit to 25 MPH vehicle speed				
**Speed Restriction will limit to 55 MPH vehicle speed, except in pump operation				

CAUTION

Do not handle electrical components after having handled diesel exhaust fluid.

ELECTRONIC FLUID CHECKS

The Electronic Fluid Checks message display is located as a selectable option within the LCD Master gauge in the dash. When the master and ignition switches are in the "ON" position, fluid levels for the power steering, windshield wiper fluid, engine coolant, and engine oil are being monitored. The transmission fluid check requires the transmission fluid to reach a certain temperature, reference the transmission manual for more information. The engine oil and power steering fluid levels cannot be accurately read while the engine is running. The display will signal a check fluid message, all levels normal or "NA". If the signal indicates, "check", refer to the applicable manual fluid check procedure for fluid fill level.

Low Oil Level Indicator

Electronic Fluid Level Checks (EFLC), wait 20-30 seconds before starting the engine. If the oil level "pop-up" comes on, the oil level may be low. Verify oil level by checking level with engine dipstick and fill accordingly.

If the engine has been recently running, be sure to allow sufficient time after shutting engine off for oil to drain back into pan. Pre-programmed settings for the switch include a 20 to 30 second delay and **do not** permit functionality when engine is above 300 RPM. The "Low Oil Level" option is available with the Cummins® and Navistar engines as part of the EFLC option.

Low Coolant Level Indicator

The instrument panel **shall** feature a low engine coolant indicator light, which **shall** be located in the center of the instrument panel. An audible alarm **shall** also be provided to warn of a low coolant incident. Verify coolant level by checking the sight glass and fill accordingly.

Transmission Oil Level Indicator

The transmission fluid **shall** be monitored electronically through the shift pad, when checking transmission level the fluid temperature **must** be at 140°F minimum. Verify transmission level with transmission dipstick and fill accordingly.

Power Steering Fluid Level Indicator

The power steering fluid **shall** be monitored electronically and **shall** send a signal to activate an audible alarm and visual warning in the instrument panel when fluid level falls below normal. Verify power steering fluid level with the power steering dipstick and fill accordingly.

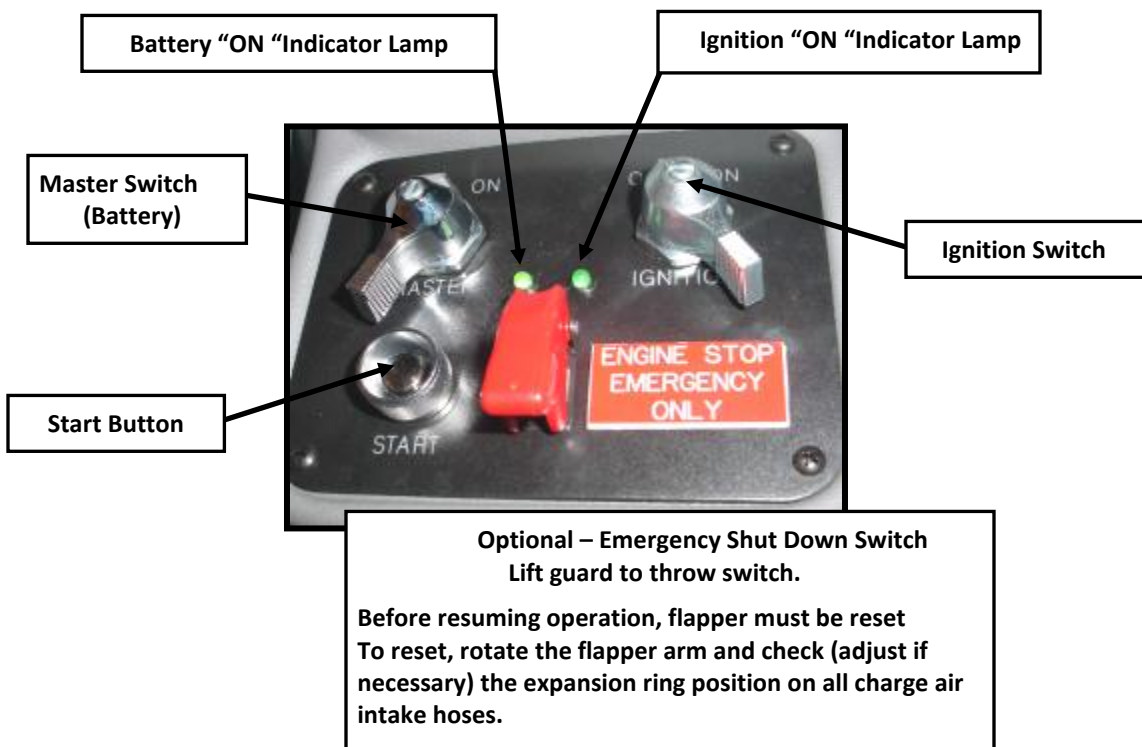
Windshield Fluid Level Indicator

The windshield washer fluid level **shall** be monitored electronically. When the washer fluid level becomes low, the amber "Check Message Center" indicator light on the instrument panel **shall** illuminate and the message center in the dual air pressure gauge **shall** display a "Check Washer Fluid Level" message. Verify washer fluid level by viewing the container and fill accordingly.

Built- In Diagnostics

The gauges reset to zero and the pointers vibrate briefly when the master is first activated and when ignition is activated the gauges should do a full sweep and the icon will illuminate for 5 seconds indicating that the gauges are operational. If communication between the chassis and gauges is lost, a message pertaining to "No Data" will be displayed and the icons pertaining to those messages will flash at an irregular rate. An amber message light will illuminate referring you to the Liquid Crystal Display (LCD) screen for message. On the LCD screen a communication error will appear.

STARTING/STOPPING



Refer to shutting down engine for recommended procedure.

CAUTION

It is important to idle an engine for 3 to 5 minutes before shutting down. This allows the lubricating oil and coolant to carry heat away from the turbo charger bearings and cylinder walls, thus allowing gradual and uniform cooling.

Master Switch

This switch energizes the electrical system from the batteries. A green LED indicates switch is in the on position.

Ignition Switch

Switches power to the starter button and accessories; use to shut down the engine when turned to the off position. A green LED indicates switch is in the on position.

Engine Start Button

Depress button to engage the cranking motor that cranks the engine if the transmission is in neutral.

To Start Engine

(Gear Selector in Neutral and Parking Brake Set)

NOTE: Pad shifters always shut down to neutral position.

1. Disconnect Electric And Air Lines From Shore Source.
2. Turn Master Switch On
3. Turn Ignition Switch On
4. Place Transmission Lever In Neutral (if equipped with "T" handle shifter)
5. Press Start Button

Normal Engine Shut Down (Gear Selector in Neutral and Parking Brake Set)

1. Turn Ignition Off.
2. Turn Master Off.
3. Connect Electric and Air Lines to Shore Source

Emergency Engine Shut Down (if equipped)

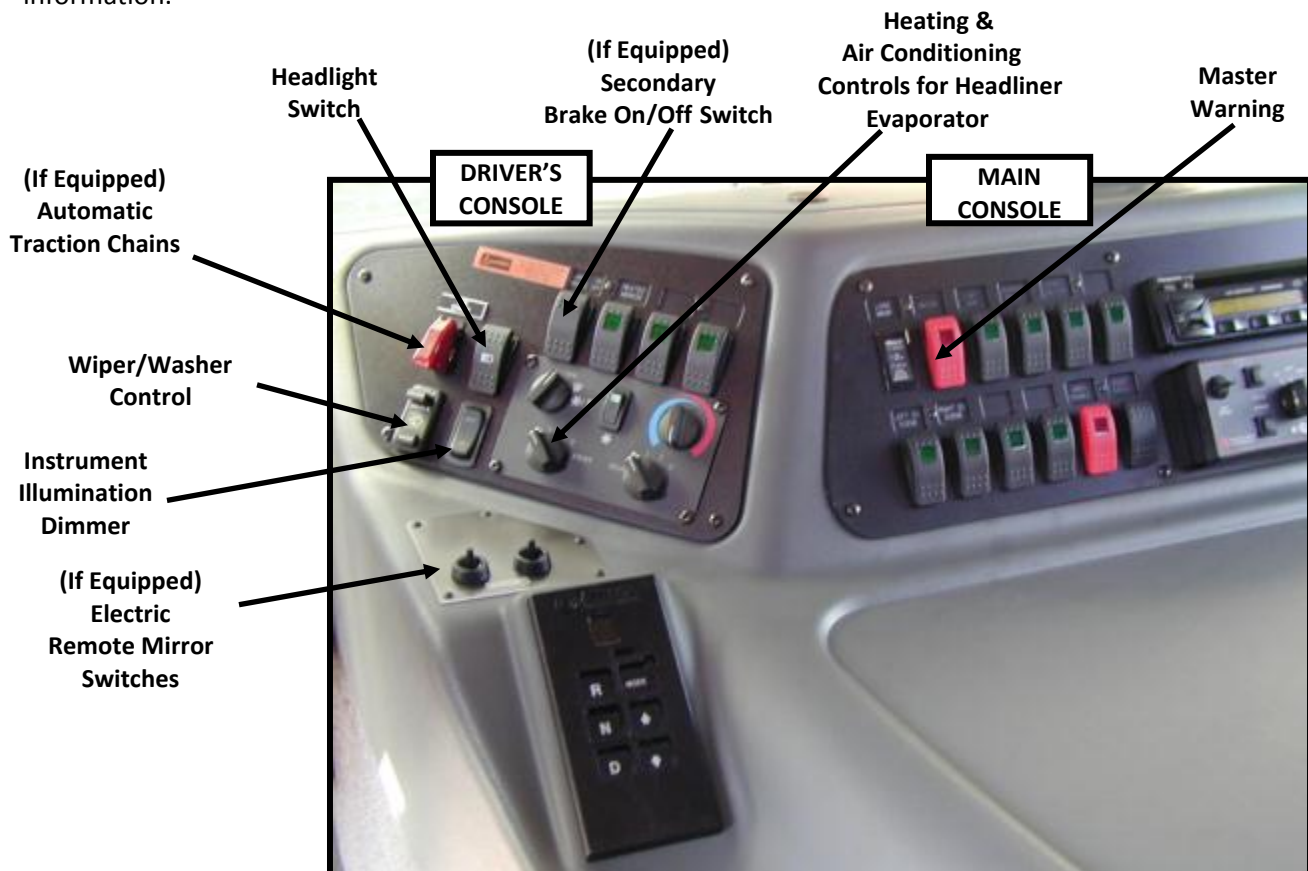
The emergency shutdown valve is located in the air intake upstream of the engine turbo or between the charge air cooler and engine air intake. It is designed to shut down the engine in a fuel vapor cloud, where the vapor could enter the air intake and cause the engine to race.

To activate, lift the guard and throw the switch or press lock “up” on locking rocker switch. Before resuming operation, valve **must** be reset and all charge air hoses, tubes, and clamps should be inspected and repositioned if needed. To reset, rotate the lever on the valve body. If no reset lever is present on the valve body, reset by holding in the dash mounted test switch for 5 seconds.

DRIVER’S CONSOLE

Switch positions and console layouts may vary based on console design and customer requested options. Not all controls described in this section are included with every product. Some controls are optional equipment. For supplemental operating information relative to the completed vehicle, refer to the respective final stage manufacturer’s literature and component manufacturer’s literature.

An optional multiplex data communication system utilizes the Vista Display that maintains many switch configurations and provides extensive information. Refer to the Vista Display Controls section for additional information.



Heating and Air Conditioning Controls

Refer to the Heating and Air Conditioning Controls section. These are present with a headliner-mounted evaporator only.

Instrument Illumination Dimmer

Push rocker to brighten/dim instrument illumination.

Wiper/Washer Control

Push lever down to turn on or shut off wipers. Move lever up for high speed or down for intermittent feature. Push lower button for wash cycle. The washer fluid tank fill is located in the driver's step or behind the grille.

Headlight Switch

Push rocker to first position for parking lights.

Push rocker to the second position for headlights.

Secondary Brake On/Off Switch (if equipped)

The auxiliary brake **must** be turned off while driving in wet or slippery conditions. It **must** be used during normal driving conditions as stated in the manufacturer guidelines for the secondary braking device.

Electric Remote Mirror Switch (if equipped)

The electric remote mirror switches adjust the mirror flat areas to the desired position by using the left or right switch.

MAIN CONSOLE

Master Warning Switch

The master warning provides power to the other warning light switches on the rocker switch console.

Light Bar (if equipped)

Controls operation of the light bar located on the cab roof; zone "A" upper.

Warning Front (if equipped)

Controls operation of the warning lights, generally located above or below the headlights; zone "A" lower.

Warning Side (if equipped)

Controls operation of the warning lights located in the sides of the front bumper or the sides of the cab/body; zone "B" and zone "D".

Warning Rear (if equipped)

Controls operation of the warning lights located at the rear of the body; zone "C" upper and lower.

Headlight Flasher (if equipped)

When in response mode, controls the flashing of only the high beams. High beams will not flash when the high beam switch is in the on position.

Automatic High Idle (if equipped)

If you have the class one load manger - if the system voltage drops to 12.8 volts for one minute, the automatic high idle system will raise the engine RPMs to increase alternator output. If you have the V-MUX[®] – if the system voltage drops to 12.5 volts the automatic high idle system will raise the engine RPMs to increase alternator output. The system will only operate with the transmission in neutral, the park brake applied, and the fire pump disengaged. The automatic high idle will stay engaged for a minimum of 10 minutes and until the system, voltage has reached 13.0 volts. Application of the service brake will override the automatic high idle and reset timer.

4 X 4 Shift Control Logic (if equipped)

NOTICE

Operation of the front axle should occur only on off-road or poor traction conditions. Engaging the front axle on paved roads may result in; driveline wind-up, inefficient operation, and excessive tire wear.

To place the vehicle in 4-wheel drive, perform the following step:

1. Ensure vehicle is stationary.
2. Place transmission in Neutral.
3. Move toggle switch to 4x4 position.
4. Verify the "4x4" indicator lamp is illuminated. If the lamp does not illuminate, place vehicle in gear ("D") and slowly accelerate.

Note: A "clunk" sound during engagement is normal.

To disengage 4-wheel drive, perform the following steps:

1. Ensure vehicle is stationary.
2. Place transmission in Neutral.
3. Move toggle switch to 4x2 position.
4. Verify the "4x4" indicator lamp is no longer illuminated.

Note: If 4-wheel drive does not disengage immediately, it may be due to wind-up in the drivelines. A short operation in reverse will usually allow disconnect to disengage.

Anti-lock Braking System (ABS)

This system continuously monitors individual wheel speed. If a wheel lockup condition is sensed, the brake pressure to that wheel will automatically be modulated when brakes are applied to prevent slippage. This allows for better stability of the vehicle during stops by avoiding skidding. The ABS system will enable reduced stopping distances on a variety of road surfaces while maintaining vehicle stability. When the engine is started, the ABS amber warning light illuminates and goes out after system is checked.

If a system failure occurs, only the affected wheel returns to normal braking function while the remaining wheels operate with ABS. Should total failure develop, the vehicle returns to standard braking without losing any of its normal efficiency.

NOTE: The ABS system is interfaced with the auxiliary braking device circuit. In the event of a wheel slip, the auxiliary braking device is disabled.

With air brake equipped vehicles, it is not advisable to pump the brake pedal. Keep steady pressure on the pedal and modulate intensity as required for safe deceleration.

Automatic Traction Control System (ATC) (if equipped)

The ATC function is similar to that of a limited slip differential. When wheel spin occurs, braking automatically applies to the spinning drive wheel. Engine speed is also decreased as needed until traction is achieved to move the chassis.

The green low traction indicator light illuminates when wheel slip is detected.

If it is desired to rock the vehicle and ATC has cut the throttle back, depress the mud and snow switch. Once depressed the ATC lamp will flash continuously until the switch is depressed again.

CAUTION

Use reasonable care when depressing the mud and snow switch. When wheel/tire suddenly regains traction, component damage can occur.

Electronic Stability Control (ESC) (if equipped)

The electronic stability control unit is a functional extension of the electronic braking system. It is able to detect any skidding of the vehicle about its vertical axis as well as any rollover tendency. The control unit comprises an angular-speed sensor that measures the vehicle's motion about the vertical axis, caused, for instance, by cornering or by skidding on a slippery road surface. An acceleration sensor measures the vehicle's lateral acceleration. The steering angle sensor, located on the column, measures the steering angle of the wheel. On the basis of lateral acceleration and steering angle, an integrated microcontroller calculates a theoretical angular speed for the stable vehicle condition. The ESC module, which is mounted on the first cross member rear of the transmission, is located in a specific location to get accurate sensor readings; this module **must** not be moved.

Items below would require recalibration:

- Steering wheel replacement.
- Any maintenance, which involves removing the Steering Angle Sensor (SAS).
- Any maintenance or repair work to the steering gear, linkage, or related component.
- Wheel alignment or wheel track adjustment.

If the tire size is changed then the customer needs to contact Spartan to determine if the ESC ECU needs to also change. And if the tire size changes and/or the ECU component changes then the ESC needs to be recalibrated.

Roll Stability Control (RSC)

Roll stability control is an option designed to assist drivers in managing the conditions that may result in commercial vehicle rollovers. When RSC senses conditions that may result in a rollover, it reduces engine torque, engages the engine retarder, applies pressure to the drive axle brakes, and may modulate the trailer brakes to slow the vehicle down (depending on the application and vehicle configuration, the steer axle brakes may be applied as well). Like ATC, RSC works automatically. The driver does not have to select this feature.

RSC uses many of the same components used by ABS and STC. Additional solenoid valves control the trailer service brakes and depending on the application, the front axle brakes during an RSC event. The solenoid for the trailer braking is a stand-alone valve that is not available as part of the ABS/ATC valve package. Depending on the application, a modulator valve may be located downstream of the solenoid valve.

Air Filter Restriction Indicator

A vacuum transducer attached to the clean air side of the air filter indicates restriction and the air filter requires servicing.

NOTE: Replace the filter when lamp is illuminated.

Fuel Priming Pump (if equipped)

An optional electric fuel priming pump can be mounted in the frame or on a cross member over the rear fuel tank. The fuel primer is activated by a momentary switch and is for priming the fuel filters or the fuel system in the event the tank has been run out of fuel.

Many engines are self-priming and **do not** require the optional electric fuel pump. Reference Engine Manufacturer's Manual.

Wait-To-Start Lamp (if equipped)

Your vehicle may be equipped with a wait-to-start lamp. The engine ECU checks the intake manifold temperature to determine how long to energize the air heater before extinguishing the pre-heat lamp. (This is for the pre-heat phase).

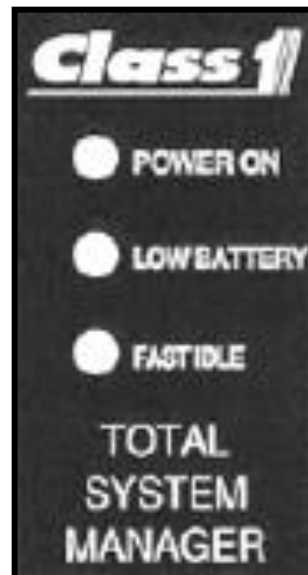
Water -In -Fuel Lamp (if equipped)

A sensor located in the fuel filter housing, activates the Water-In-Fuel (WIF) lamp. A WIF lamp illuminates indicating that the filter needs to be drained from the fuel filter assembly.

CLASS 1 TOTAL SYSTEM MANAGER (IF EQUIPPED)

SEQUENCING: To reduce strain on the chassis' charging system, any loads controlled by the load manager can be programmed to turn on in sequence when the activating switch (either ignition or master warning light switch) is closed. Each load can be assigned to one of eight sequence stages. The loads will sequence off in reverse order.

SHEDDING: To reduce the demand on the chassis' charging system, nonessential loads controlled by the load manager can be programmed to turn off under conditions of extreme electrical load. Eight of the twelve outputs controlled by the load manager can be assigned to shed at one of eight priority levels. The lowest priority loads will begin to shed when the system voltage drops to 12.7 volts, and all loads programmed to shed will turn off after the system voltage drops to 11.0 volts. In order for a load to shed, the system voltage **must** drop below the shed point voltage for a minimum of one minute. Shed loads will remain off for a minimum of 5 minutes and will not turn on again until the system voltage rises above the unshed point for one minute.



Load shedding is only active with the park brake set (scene mode). Each load controlled by the load manager can be given a shed priority independent of its sequence.

Automatic High Idle (if equipped)

To increase alternator output under conditions of extreme electrical load, the load manager will boost the engine idle speed after the system voltage drops below 12.8 volts for at least one minute. The high idle will remain active for at least 10 minutes and until the system voltage has stabilized above 13.0 volts. Automatic high idle will only be available with the park brake set, transmission in neutral, and when fire pump is disengaged. The automatic high idle function can be deactivated by depressing the brake pedal. Automatic high idle mode is indicated by the "FAST IDLE" light in the load manager display.

Low Voltage Light

The load manager provides a "LOW BATTERY" light in the load manager display and activates the alarm when the system voltage falls below 11.9 volts.

LOAD MANAGER DISPLAY

The load manager comes standard with a status display that fits conveniently in a standard rocker switch cutout. The display has LED tell tales for "POWER ON", "LOW BATTERY", and "FAST IDLE".

Operational Data

<u>*SHED POINTS</u>		<u>*UNSHED POINTS</u>	
Level 0	Never Shed	Level 1	11.4
Level 1	11.0 Volts	Level 2	11.6
Level 2	11.4 Volts	Level 3	12.0
Level 3	11.8 Volts	Level 4	12.2
Level 4	12.0 Volts	Level 5	12.4
Level 5	12.2 Volts	Level 6	12.6
Level 6	12.4 Volts	Level 7	12.8
Level 7	12.6 Volts	Level 8	13.0
Level 8	12.7 Volts		

SEQUENCING

Electrical loads will turn on sequentially in priority order from 1 to 8 when their respective switch is activated (either ignition or warning master) and the vehicle is operated in the mode selected for that output (response and/or scene). Loads will sequence off in reverse order. Priority zero loads will be sequenced on and off, but will not shed.

SHEDDING

Electrical loads will be turned off (shed) when the system voltage drops to the shed point for a minimum of one minute (this prevents load shedding due to momentary system power loading such as high current start-up devices). Once shed, loads will remain off for a minimum of five minutes and until the unshed voltage is achieved for a minimum of one minute. Loads will only shed if the Parking Brake is set and the Load Manage Enable input is "grounded".

NOTE: SHED POINT is the voltage that will cause a load to be turned off if the system voltage drops to this point.

UNSHED POINT is the voltage that **must** be achieved before a load is turned back on once it has been shed.

SWITCH SOURCES

IGNITION:	Loads will sequence on when the vehicle ignition switch is turned ON.
MASTER WARNING:	Loads will sequence on when the master warning switch is turned ON.

FAST IDLE

A fast Idle output is activated whenever the system voltage is reduced to 12.8 VDC for at least one minute. The fast idle output will remain ON for a minimum of 10 minutes and until 13.0 VDC is achieved. The fast idle output is dependent on the Parking Brake and Load Manage Enable inputs.

NOTE 1: This output should only be used as part of a fast idle control system when the proper safety interlocks are present.

NOTE 2: The FAST IDLE output will turn off immediately when the Load Manage Enable input is removed from ground potential.

LOW VOLTAGE ALARM

Whenever the system voltage drops below 11.9 VDC, a low voltage alarm output (ground) is activated. This complies with the NFPA® 1901 requirements.

OUTPUT MODES

RESPONSE MODE:	Output is ON only when the Park Brake is NOT set
SCENE MODE:	Output is ON only when the Park Brake IS set

EACH LOAD CAN BE PROGRAMMED FOR ACTIVATION
BY EITHER SOURCE

BOTH

Output is ON in both Response
and Scene Mode

EACH LOAD CAN BE PROGRAMMED FOR RESPONSE
MODE, SCENE MODE OR BOTH

USER SET POINT/VARIABLE TRIP

This is the user definable output. The user has the option of selecting a "trip" voltage between 10.5 and 15.0 VDC. If the trip point is set to 13.8V or above, the output acts as an over voltage indicator and will "energize" when the voltage drops to the set point.

OPERATING VOLTAGE

7.5 TO 20 Volts D.C.

OUTPUTS

High Side Drivers	Vmain at 0.5 amp. (source)
Low Side Drivers	Ground at 0.5 amp. (sink)

AUXILIARY BATTERY MONITORING

Terminal #23 can be used to monitor an auxiliary battery. There should be no connection to this terminal if a remote battery is not monitored. If the auxiliary battery voltage drops below 11.9 volts, it will activate the auxiliary battery low output.

TRANSIENT SUPPRESSION

Outputs are protected against thermal overload, direct shorts and transient spikes from -50 to +60 volts D.C.

OVERRIDE

Located on the PC Board of the load manager. Outputs 1 through 12 are forced on when the override switch is active.

Twelve (12) outputs can be programmed by the user to be activated by the ignition or Master Switch tied to Scene Mode, Response Mode or Both, and assigned a Specific Priority Level. More than one output load can be set to the same Priority Level.

ON BOARD DIAGNOSTIC (OBD) (IF EQUIPPED)

The following components or systems due to OBD/emissions system certification **must** not be modified:

- Vehicle Speed Sensor
- Coolant Level Sensor
- Ambient Air Temperature Sensor
- Vehicle Accelerator Pedal
- Malfunction Indicator Lamp (MIL)
- 9-pin Diagnostic Interface connector
- OBD designated connector by black cap marked, "OBD" or an uncapped 9 pin diagnostic connector



OR



- Any component/system of the aftertreatment.

Owners/Operators:

- **SHALL NOT** install object(s) that will result in abnormal temperature to occur on the emissions control system.
- **SHALL NOT** restrict access to fill tube or label for the DEF tank .
- **SHALL NOT** install anything that will cause the designated OBD, 9-pin Diagnostic Interface, connector to be covered or obstructed.
- **SHALL** maintain proper clearance of their add-on devices to the high temperature components of the emissions control systems. Refer to applicable section in engine manufacturer's manual.
- **SHALL** take their unit to an authorized service center once incorrect Diesel Exhaust Fluid has been detected.

Malfunction Indicator Lamp (MIL) (If Equipped)

The MIL may illuminate when the ECM detects any failure that could affect tail pipe emissions. Certain failures which may occur will result in an illuminated MIL, contact an authorized service facility or Spartan Customer & Support Group at 1-800-543-5008.

For additional information please refer to the applicable manufacturer's manual

MULTIPLEX CONTROL VISTA DISPLAY (IF EQUIPPED)

Certain chassis cabs may be equipped with a Weldon Multiplex System, or V-Mux®, in conjunction with conventional wiring controls. The driver and/or operator interface for this system consists of one or more visual displays known as “Vista(s)” located in or near the frontal switch panel area.

VISTA IV STANDARD CONTROLS

HOME MENU



VISTA IV CONTROL INTERFACE FEATURES

Clock

Time is displayed in the upper right corner of the screen.

Message Bar

Important messages that need acknowledgement by the user are displayed at the top of the screen in the order that they are received. Refer to Message Acknowledge button section.

Graphics Area

The center area of the display may be programmed to show general information such as high idle status, body builder info, or illustrative view of the chassis to indicate when a door is ajar.

Seat Belt Indicator

The seat belt indicator will be displayed if the Vehicle Data Recorder (VDR) identifies a seat belt error. This will indicate that a seat is occupied but the occupant is unbuckled or a buckled seat is unoccupied.

Climate Control Indicator

If HVAC is controlled by the V-Mux® system, then the climate control indicator displays the state of HVAC system.



VISTA IV DISPLAY CONTROL BUTTONS WITH HEAT A/C (ITEMS 1-7)

There are seven “soft touch” menu option buttons on the lower panel of the Vista display housing. An indicator light above each button illuminates when the function is activated by depressing the corresponding button. The red “E-Master” (1) button and the green “High Idle” (7) button are toggle controls that activate/deactivate the function when depressed. Buttons 2 - 5 allow instant access to all other Main Menus. Button 6 is for HVAC.



1. E-Master Button

The red ON/OFF Control for the Master Warning Lights. It toggles all warning lights on and off.

2. Warning Lt Menu Button

Accesses the Warning Light Menu where individual warning light installations can be turned on and off.

3. Home Menu Button

When the chassis is first powered up, the Vista displays the Home Menu. Typically, functions that are most important to the driver will be located here. The home button allows return from other selected menus.

4. Secondary Menu Button

The Secondary Menu is where additional lower priority operator controls may be located.

5. System Info Menu Button

Pressing the System Info button accesses the main System Info Menu. Refer to System Info section.

6. Heat A/C Menu Button

If equipped with a single overhead HVAC system, the HVAC button accesses the main HVAC menu. If equipped with a dual overhead HVAC system, the HVAC button toggles through the Climate Control Modes.

7. High Idle Menu Button

The green high idle button is for manual activation/deactivation of the high idle control.

To activate high idle, the transmission **must** be shifted into neutral range, the parking brake set and the fire pump disengaged.

To deactivate the manual high idle the operator may press the manual high idle button or release the parking brake.

Main display will indicate when high idle is Disabled, Enabled, or Active.

NOTE: Auto high idle (a standard feature) will become enabled when system voltage drops below 12.5 volts. It will automatically disable when system voltage obtains 13.0 volts. Auto high idle can be manually circumvented by depressing and holding the service brake pedal or by release of the park brake.

VISTA IV DISPLAY CONTROL BUTTONS WITHOUT HEAT A/C (ITEMS 1-7)

There are seven “soft touch” menu option buttons on the lower panel of the Vista display housing. An indicator light above each button illuminates when the function is activated by depressing the corresponding button. The red “E-Master” (1) button and the green “High Idle” (7) button are toggle controls that activate/deactivate the function when depressed. Buttons 2 - 6 allow instant access to all other Main Menus.



1. E-Master Button

The red ON/OFF Control for the Master Warning Lights. It toggles all warning lights on and off.

2. Warning Lt Menu Button

Accesses the Warning Light Menu where individual warning light installations can be turned on and off.

3. Home Menu Button

When the chassis is first powered up, the Vista displays the Home Menu. Typically, functions that are most important to the driver will be located here. The home button allows return from other selected menus.

4. Secondary Menu Button

The Secondary Menu is where additional lower priority operator controls may be located.

5. System Info Menu Button

Pressing the System Info button accesses the main System Info Menu. – Refer to System Info section.

6. System Info. 2 Menu Button

Pressing the System Info 2 button accesses the diagnostic menu.

7. High Idle Menu Button

The green high idle button is for manual activation/deactivation of the high idle control.

To activate high idle, the transmission **must** be shifted into neutral range, the parking brake set and the fire pump disengaged.

To deactivate the manual high idle the operator may press the manual high idle button or release the parking brake.

Main display will indicate when high idle is Disabled, Enabled, or Active.

NOTE: Auto high idle (a standard feature) will become enabled when system voltage drops below 12.5 volts. It will automatically disable when system voltage obtains 13.0 volts. Auto high idle can be manually circumvented by depressing and holding the service brake pedal or by release of the park brake.

MULTI-FUNCTION BUTTONS (ITEMS 8)

There are four multi-function buttons (Items 8) on each side of the Vista display. The active menu determines the function of each button.



Headlights

Toggles through and displays states of Marker lights, Low Beam, and High Beam headlights.

Dimmer

Controls Vista and soft touch button backlighting. Toggles through MAX, NORMAL, DIM, and NIGHT modes with 25% approx. difference in brightness between levels. Also provides control over gauge and dash backlighting when marker lights are active.

Secondary (Aux) Braking Devices – (If equipped)

Provides control over and indicates status of Secondary Braking Devices.

Message Acknowledge

When depressed this button clears the current message in the Message Bar and displays the next message, if any.

Additional Driver Functions – (If equipped)

Items such as Tire Chains, Automotive Traction Control (ATC, Mud/Snow), and PTO On/Off controls are commonly located in remaining positions.

SECONDARY MENU

Additional functions (If equipped) requiring operator interface.



WARNING LIGHT MENU

Allows individual control over specific Warning Light installations.



SYSTEM INFO MENU

Provides access to sub-menus containing Chassis, Engine and Transmission information, Maintenance Schedule, Date/Time adjustment, and diagnostic menus.



Chassis Info

Chassis Info displays the Sales Order information, Vehicle Identification Number (VIN), paint numbers, and programming template revision level.

Engine Info

Engine Info displays the engine type, serial number, fluid fill information, and replacement engine filter part numbers.

Transmission Info

Transmission Info displays the transmission type; serial number, fluid fill information, and replacement transmission filter part number.

Seat Info

Provides a link to the Seat Info screen. The Seat Info screen displays all seats and indicates if the seat is occupied and properly buckled.

Date/Time Adjustment

Access to Date/Time adjustment sub-menu.

Maintenance Schedule

Provides important increments for scheduled maintenance.

Diagnostics Menu

Provides a link to the Diagnostics Menu.

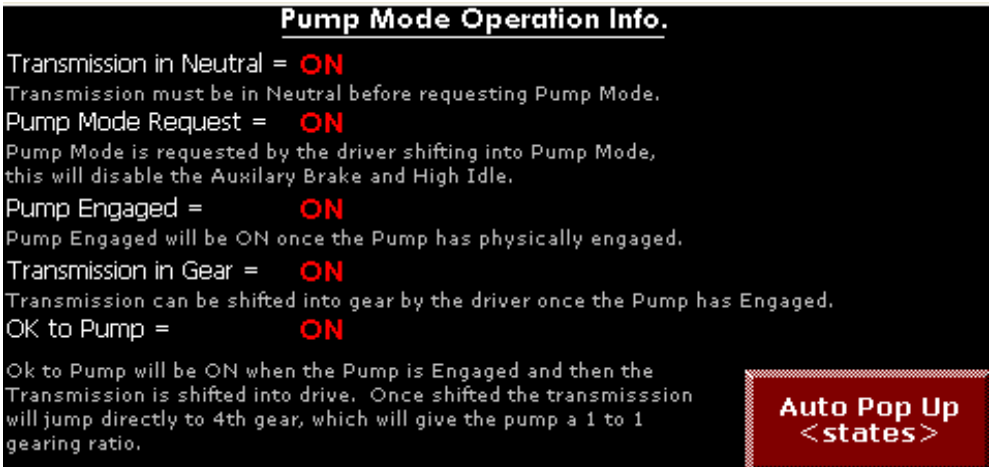
DIAGNOSTICS MENU

Provides access to Diagnostics sub-menus. Further links to operational and diagnostic menus are provided here. Gauge Diagnostics (a text only screen) details dash mounted Gauge settings and diagnostic procedures.



PUMP MODE INFO – (IF EQUIPPED)

Provides operational information governing pump status. This screen will automatically display when the operator shifts into Pump Mode. If desired, screen can be disabled via “Auto” override button in bottom right corner.



HVAC DIAGNOSTICS FOR DUAL OVERHEAD SYSTEM

Provides detailed operational status of HVAC system inputs and outputs to aide in troubleshoot and diagnostics. Refer to Climate Control Menu section.

00.0 V		SPARTAN CHASSIS INC.		12:01
Ignition Status = ON		Compressor Clutch = On		
Ignition is required for Blower fans, AC Clutch, and Condenser.		The Compressor Clutch will be on with Ignition, A/C, and Comfort Mode. The Compressor Clutch will also be on with Ignition and Cabin or Deforst Modes.		
A/C Defrost Signal = On				
A/C Comfort Signal = On		DFR/Comfort Power = On		
A/C Comfort Signal will be on in Comfort Mode.		DFR/Comfort Power will be on with Ignition and Comfort, Cabin or Deforst Mode.		
Inside Temperature = 00 °F		Climate Control Mode = HVAC Status		

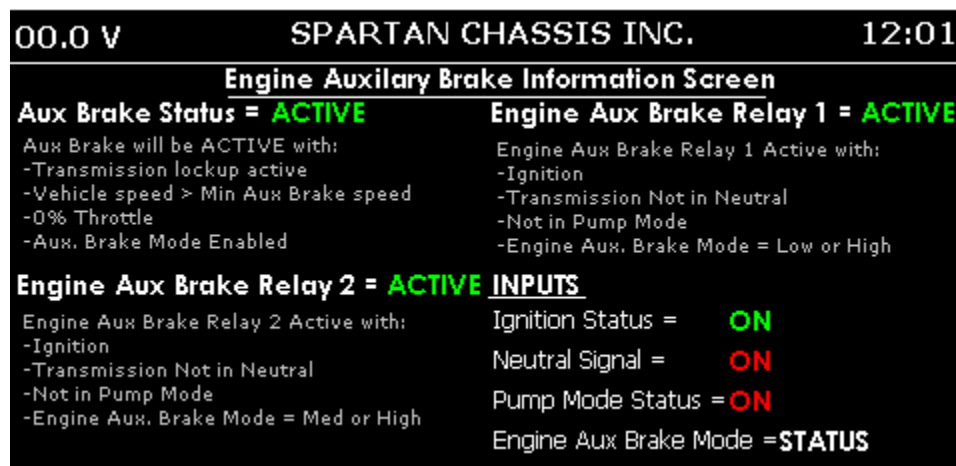
HVAC DIAGNOSTICS FOR SINGLE OVERHEAD HVAC SYSTEM

Provides detailed operational status of HVAC system. A secondary means of Climate Mode selection is available to aid in trouble-shooting and diagnosis. Refer to Climate Control Menu section.

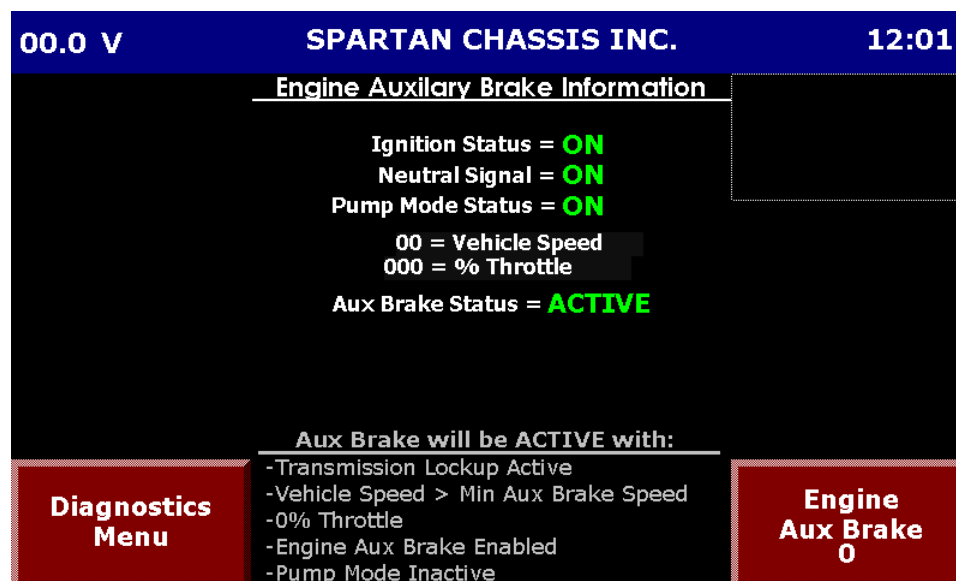
00.0 V		SPARTAN CHASSIS INC.		12:01
Ignition Status = ON		Front Thermostat Status = Closed		
Ignition is required for Blower fans, AC Clutch, and Condenser.		Front thermostat will OPEN if front evaporator freezes.		
Low Pressure Switch Status = Closed		Rear Thermostat Status = Closed		
LP switch will OPEN if suction line refrigerant pressure is too low disengaging AC clutch.		Rear thermostat will OPEN if rear evaporator freezes. When OPEN the liquid solenoid will CLOSE and divert refrigerant flow to front evaporator only.		
AC Pressure Switch Status = Closed		Air Distributor Relay Status = ON		
AC Pressure switch will OPEN if refrigerant pressure is outside the normal operating range disengaging AC clutch.		Air distributor relay will be OFF in Defrost/Defog and Split modes forcing air to flow at the windshield.		
Temperature Set Point = 00 °C		Climate Control Mode = HVAC Status		
Inside Temperature = 00 °C				

ENGINE (SECONDARY) AUX BRAKE DIAGNOSTICS

Provides detailed operational status of auxiliary braking devices. A secondary means of Brake Mode selection is available to aid in trouble-shooting and diagnosis.



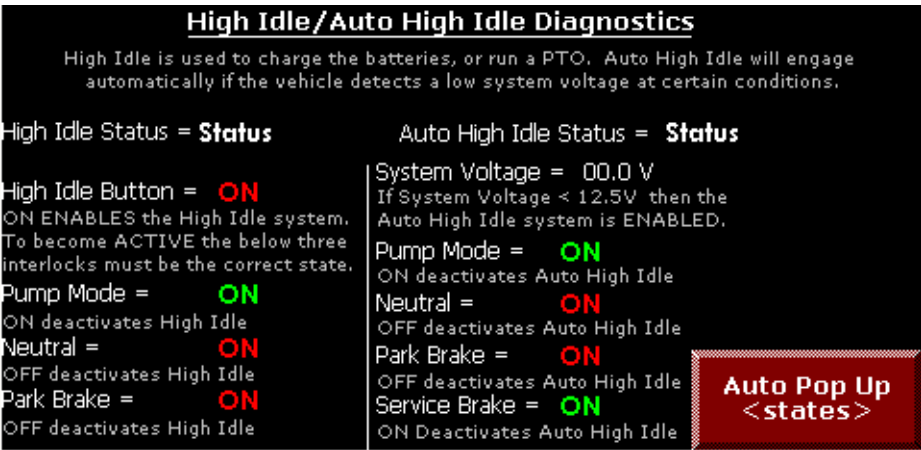
Rocker Switch



Vista Screen

HIGH IDLE DIAGNOSTICS

Provides detailed operational information on High Idle and Auto High Idle status. This screen automatically displays when either high idle state is active. If desired, screen can be disabled via “Auto” override button in bottom right corner.



OCCUPANT RESTRAINT STATUS

Provides occupant restraint status. This screen will automatically display when a seat is occupied and the seatbelt is not buckled while the park break is inactive. If desired, the screen can be disabled via the “Auto Pop-Up” button on the Vista. The setting will be saved if the truck is turned off after 15 seconds from when the setting was changed.



V-MUX® DIAGNOSTICS MENU

Provides access to V-Mux® Diagnostics sub-menus.

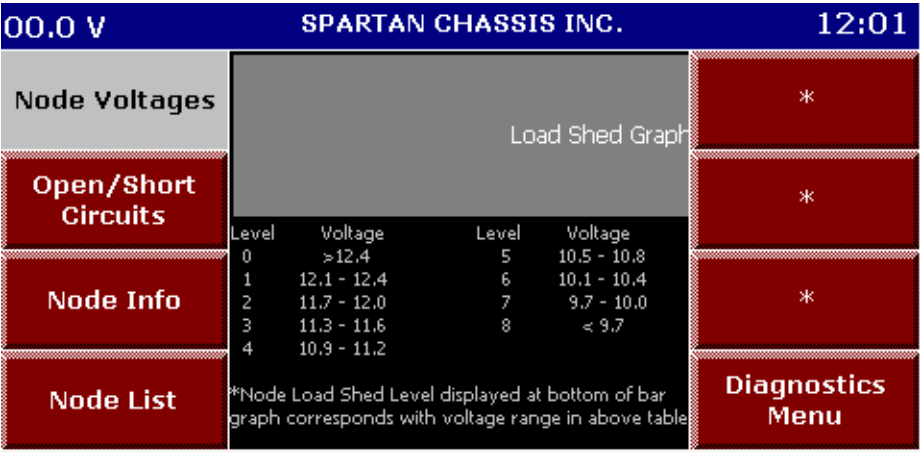
Node Info

Verifies the Vista display operating system and version of System Designer programming software used during last download.



Node Voltages

Monitors voltage and Node load shedding levels.



Open/Short Circuits

Monitors the circuit (open/short) status of Node Outputs.

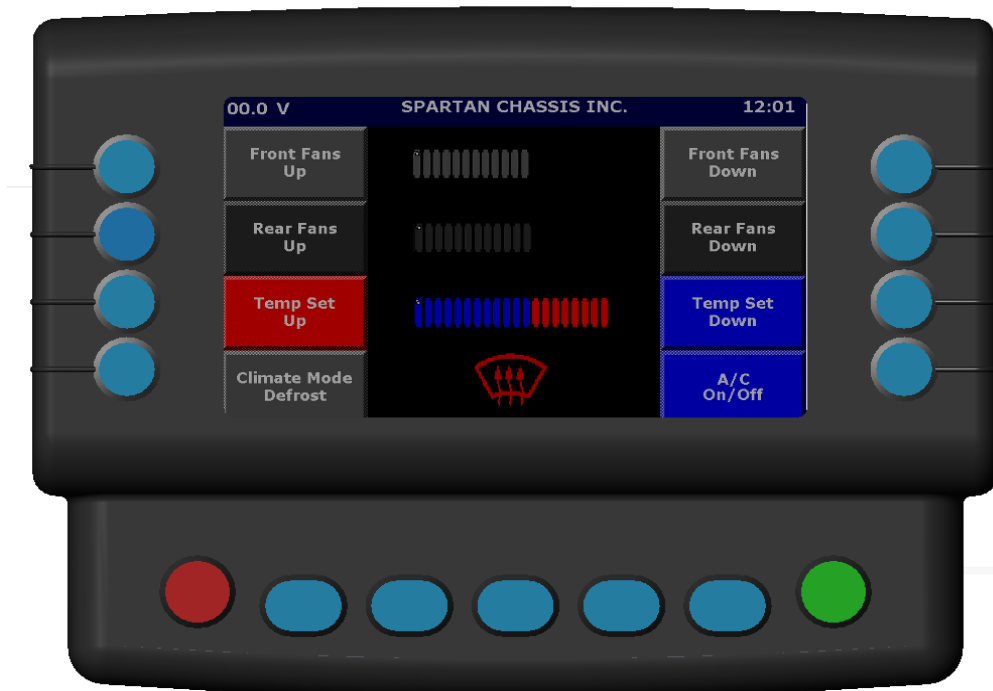
00.0 V	SPARTAN CHASSIS INC.		12:01
Node Voltages	System Faults	*	
Open/Short Circuits		*	
Node Info		*	
Node List		Diagnostics Menu	

Node List

Displays Node types, locations, and operational status. “Ping” button allows status updates as desired.

00.0 V	SPARTAN CHASSIS INC.		12:01
Node Voltages	Nodes	Status	Location
Open/Short Circuits	Node List	Ping Box	Behind Gauges Behind Officer Glovebox Behind Rocker Switches Overhead H.V.A.C. Driver Dash
Node Info			
Node List			
			Ping
			*
			*
			Diagnostics Menu

HVAC MENU FOR DUAL OVERHEAD SYSTEM



The Climate Control Menu provides direct access to HVAC settings using the function buttons.

Climate Mode (HVAC status) button

Allows selection between four specific “Modes”: OFF, CABIN, COMFORT, and DEFROST.

Fan Speed Control Buttons

Set the “mode control switch” to “comfort” mode for cab heating and cooling.

Set the “mode control switch” to “defrost” mode for windshield defrosting/defogging need. Even in this mode, 2 (two) vents will remain on for cab heating and cooling.

Cab master and ignitions switches **must** be in the “ON” position to operate the fans.

Set the “mode control switch” to “cabin” mode and this will split the airflow evenly between “comfort” mode and “defrost” mode.

The temperature control switch allows user to adjust temperature between hot and cold.

The “rear” blower speed control switch allows operator to control blower speed.

The “front” blower speed control switch allows operators to control blower speed.

The A/C switch located in the lower right of the display allows operator to activate or deactivate the A/C compressor. When the A/C on/off button is pressed to turn the compressor on, the A/C on/off icon turns from grey to blue.

Set Temperature Control Buttons

When in CABIN, COMFORT, or DEFROST mode the Set Temp Control Buttons are used to adjust the inside cabin temperature to the desired level.

NOTE: When in defrost or cabin air modes, air is directed toward the windshield to prevent fogging; A/C is also commanded active to dry the air inside the cabin.

HVAC MENU FOR SINGLE OVERHEAD HVAC SYSTEM



The Climate Control Menu provides direct access to HVAC settings using the multi-function (type 8) buttons.

Climate Mode (HVAC Status) Button

Allows selection between six specific “Modes”: OFF, AUTO, MAX HEAT, MAX A/C, DEFOG, and DEFROST.

Fan Speed Control Buttons

Fan speed is adjustable in MAX HEAT, MAX A/C and DEFOG modes with only front fans being available in DEFROST. Fans will not be operational unless both cab Master and Ignition switches are in the “ON” position. Initial start-up defaults are at 100% to maximize operational response.

Set Temp Control Buttons

When in AUTO or DEFOG mode the Set Temp control buttons (up/down) are used to adjust the inside cabin temperature to the desired level.

NOTE: When in DEFROST full available heat output (Max) is directed to the front windshield for optimum efficiency. As implied, MAX HEAT and MAX A/C also operate at full heating or cooling power. Temperature settings are not “User” adjustable in these modes although output can be tailored through the use of the Fan Speed control buttons.

Auto Mode

This setting regulates cabin temperature with the use of the heater control valve, fans, and A/C system. The temperature set point in comparison to the inside temperature is used to decide the system heating/cooling response and will automatically adjust the front and rear fan speeds accordingly. Output is via the side comfort and rear HVAC louvers.

Max Heat Mode

Heater valve is fully open directing maximum flow of engine coolant through the heater coils. Output is via the side comfort and rear HVAC louvers.

Max A/C Mode

Heater valve is fully closed allowing A/C system to provide maximum cooling power.
Output is via the side comfort and rear HVAC louvers.

Defog Mode

Output is via the front (defrost) and rear HVAC louvers. Heat/cool temperature provided is dependent on the user set point.

Defrost/Defog Mode

Heater valve is fully open directing maximum flow of engine coolant through the heater coils.
Output is via the front HVAC louvers being directed at the windshield only. Since temperature is not user adjustable, once defrost or defogging has been achieved, it is recommended that user switch to either Auto or Defog mode to maintain air comfort at desired level.

HEAT A/C - CLIMATE CONTROL MENU - TUNNEL MOUNTED AUXILIARY HVAC AND UPPER HEATER/DEFROSTER UNIT.**Climate Mode (HVAC Status) Button**

Allows selection between four basic "Modes": OFF, MAX HEAT, and MAX A/C of the tunnel mounted HVAC unit. The upper heating and defrosting capabilities are provided by an independent manually operated heater/defroster unit mounted overhead just rear of the windshield.

Fan Speed Control Buttons

Fan speed is fully adjustable in both MAX HEAT and MAX A/C. Initial start-up defaults are at 100% to maximize operational response. If both front and rear fans are adjusted to OFF (0%) the current climate mode selection will automatically default to OFF Mode.

Set Temp Control Buttons

Used to adjust the inside cabin temperature (up/down) to the desired level, only operational in AUTO Mode.

Max Heat Mode

Heater valve is fully open directing maximum flow of engine coolant through the heater coils.
Air output is via all louvers.

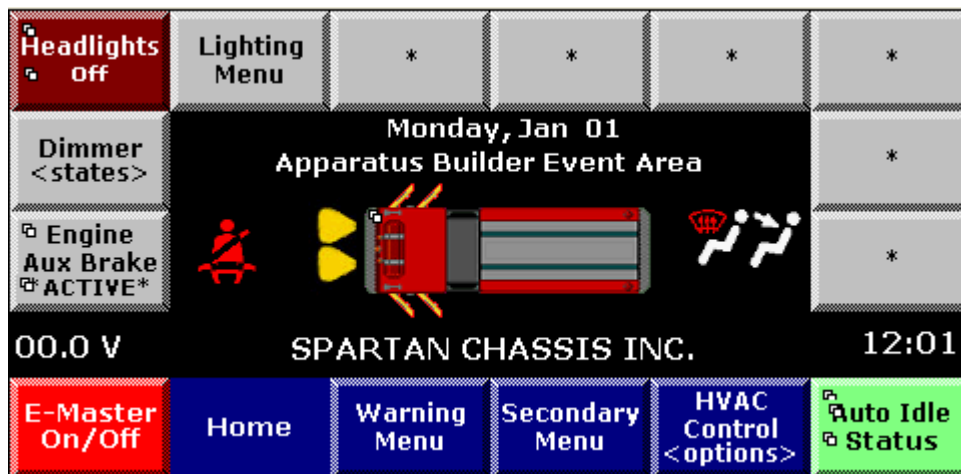
Max A/C Mode

Heater valve is fully closed allowing A/C system to provide maximum cooling power.
Air output is via all louvers.

VISTA TOUCH SCREEN (IF EQUIPPED)

As an alternative to the Vista IV, an enhanced interface “Touch Screen” version of the Vista display may be installed. All user functions are located within the graphics area of the display therefore no buttons are located around the perimeter.

HOME MENU



As configured, three Menus and three Control buttons are provided along the bottom row.

“E-Master”, “HVAC Control”, and “High Idle” perform the same function as on the Vista IV with an added visual color shift when toggled into the ON position.

Successive menus and screen layouts are similar to the Vista III. In addition to the Main (start-up) Home menu, sub-menu “Secondary Menu” buttons are also provided. The “Warning Menu” button (same as Vista IV) links to the Warning menu screen.

Message Acknowledge (Fire Truck Icon)

To acknowledge a message, touch the fire truck image in the center of the screen. When the truck icon is depressed, the current message is cleared in the Message Bar and the next message is displayed, if any.

VDR Screen Link (Seat Belt Icon)

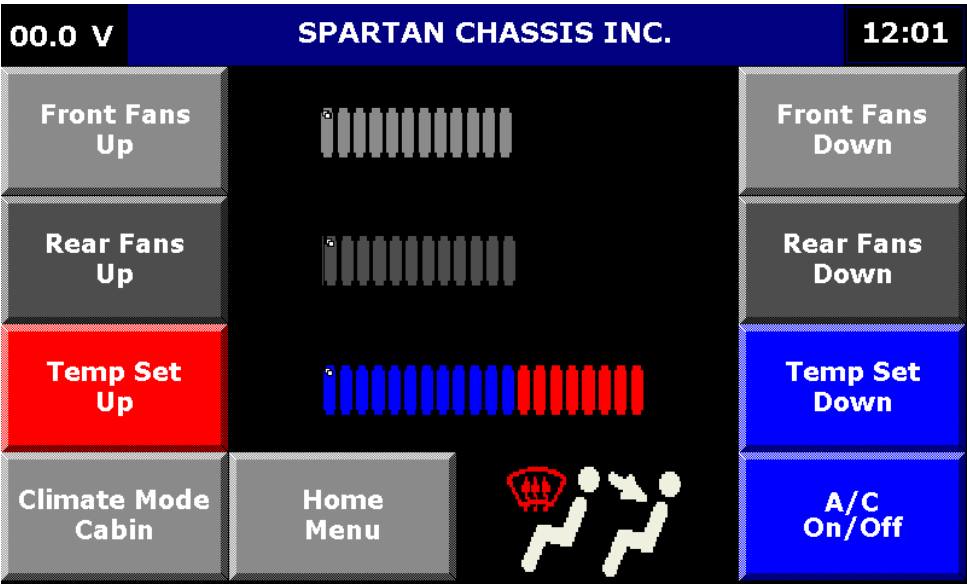
When a seat belt violation occurs, the Seat Belt Icon appears on the screen to indicate the violation. To determine which seat is in violation, touch the seat icon to view the Seat Information Screen.

HVAC Screen Link (HVAC Icon)

The HVAC Control button on the bottom row is used to set the mode of the HVAC system. The mode is displayed via the HVAC Icon just above the button. To view the HVAC Climate Control Menu, touch the HVAC Icon.

HVAC MENU FOR DUAL OVERHEAD HVAC SYSTEM

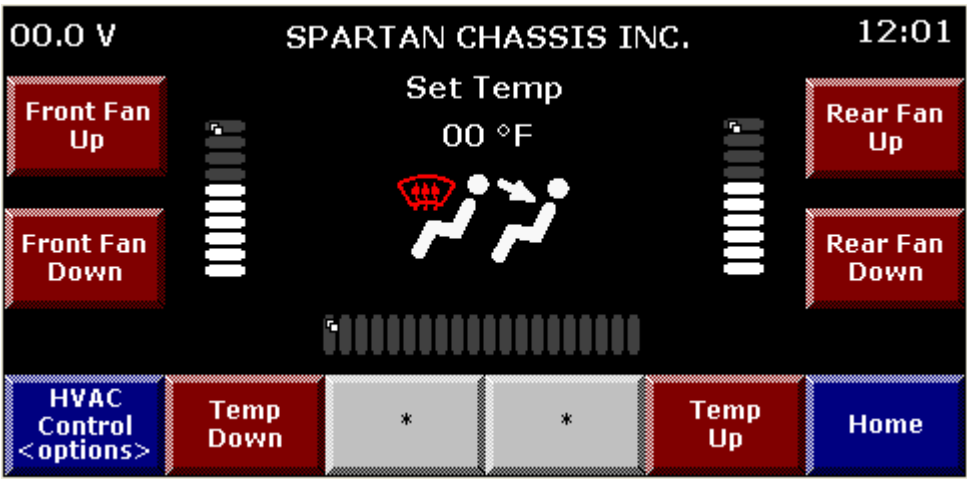
Using the climate control menu, front and rear fans, temp up and down adjustments can be accomplished by their respective virtual button.



HVAC Control Button determines the Mode of HVAC. Once Mode is determined, the front and rear fan speeds and temperature can be set using virtual buttons on HVAC menu screen.

HVAC MENU FOR SINGLE OVERHEAD HVAC SYSTEM

Using the climate control menu, front and rear fans, temp up and down adjustments can be accomplished by their respective virtual button.



HVAC Control Button determines the Mode of HVAC. Once Mode is determined, the front and rear fan speeds and temperature can be set using virtual buttons on HVAC menu screen.

Remaining menus and screen organizations are patterned after the Vista IV detailed in the preceding section.

Final Notes:

By nature, the Weldon V-Mux® system lends itself to a high level of customization.

The behavioral characteristics or operations “Programming” of the V-Mux® system is achieved through the use of specialized software at the factory level. Spartan produces and programs support consistent with the needs of the mechanical and electrical content of each particular chassis at time of chassis build. Descriptions, menus, and screens depicted within this document reflect the programming and user interface provided at the time chassis leaves our facility.

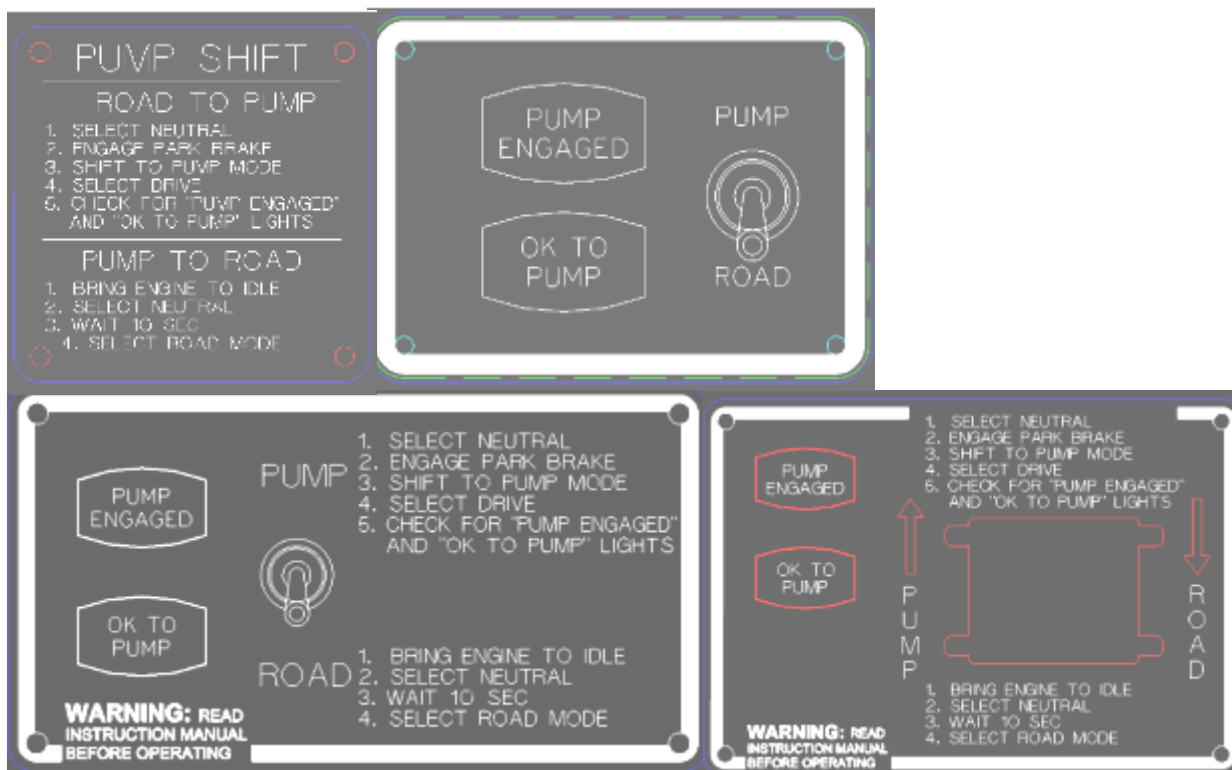
Upon completion of the chassis, the base or “Initial” programming design file passes on to and becomes the property of the Final Stage Manufacturer Contractor. Additions to the V-Mux® installation and Vista interface (sometimes extensively) are performed in order to support their requirements and specific brand recognition. As required, for information or instruction on portions of the interface not covered in this document please contact your appropriate Dealer or Apparatus Manufacturer point of purchase.

PUMP SHIFT CONTROL (IF EQUIPPED)

Your truck may be equipped with a Spartan supplied Pump Shift Control. Located left of the steering column just below the instrument panel or a toggle switch located on the main console. Below are pictures of the three versions of pump shift panels you may have in the unit.



Read Pump Manufacturer’s Instruction Manual before operating



FUSES

The fuses comply with the following: mini (SAE J2077) & Maxi (SAE J1888), and ATO Blade Fuse rated.

RELAYS

The relays are automotive relays with ISO 280 footprint, Ultra Micro ISO Automotive relay, or high power automotive relay.

ELECTRICAL INFORMATION

CIRCUIT BREAKERS

The circuit breakers are SAE J553, type 1, 2, or 3.

BATTERY

The Battery manufacturer's manual, included with the unit, contains information about the proper care of the batteries equipped on your chassis. Batteries **must** be maintained in accordance with the recommendations in the battery manufacturer's manual to ensure full battery life. Your vehicle may be equipped with an onboard battery charger for the purpose of maintaining the battery's charge level during periods of inactivity. If your chassis is not equipped with such a battery charger, you **must** provide a means of keeping the batteries properly charged during periods of inactivity.

Battery removal and terminal maintenance: When replacing cables install positive terminal first and install negative terminal last. Battery terminals should be cleaned and installed with a dielectric compound or coated with battery terminal spray or clear polyurethane spray. Battery jumper studs are provided, for ease of jump starting.



Placing a wrench on the positive terminal without removal of the negative connection first, or contact of a wrench between posts,

can result in a spark that could explode the battery. Prior to disconnecting the battery cables, ensure the unit has been off at least 70 seconds, disconnect the positive cable first, then the negative cable, and ECU connectors when performing electrical service, or welding on apparatus, to protect the microprocessors on chassis. Proper eye and apparel protection is required.



INTERFACE POINTS

There **shall** be no case grounding of components to the cab structure, and **must** be made through the designated electrical interface points. Refer to the appropriate Final Stage Manufacturer's literature for additional information. Guidelines for Body interface requirements are provided to our Final Stage Manufacturer's as published in the Emergency Response Apparatus Builders Manual.

COMMUNICATION EQUIPMENT REQUIREMENTS: (RADIO, AMPLIFIER, HEADSET AND/OR MICROPHONE STATIONS, AND AUDIO VIDEO EQUIPMENT)

Electronic modules having audible transmission and receiving capabilities cannot achieve absolute ground therefore the following requirements/recommendations **must** be reviewed and specified, where applicable:

The OEM of the module may supply mounting and grounding specifications. Such specifications **shall** supersede the requirements listed below. However when superseded or deviated a full systems check **must** occur to assure zero transmission interference and unwanted noise for all audio systems within the vehicle.

Radios, intercoms or other electronic communication devices **shall** be grounded to the batteries. Proper grounding techniques will aid in the reduction of noise or other sources of electromagnetic interference from degrading the performance of the device. Modules requiring chassis ground to the module envelope or case **must** have packaging specifications requiring isolated mounting assuring no electrical ground path between the module envelope or case and cab/frame.

Shielded cable **shall** be jacketed to prevent potential ground differential.

Communication cabling for audio and voice **must** be jacketed, twisted conductor and shielded.

All Communication Equipment Modules should share a single ground point.

All Communication Equipment Modules having a designated return ground should be connected to common ground connection.

All Communication Equipment Module Ground and Communication Equipment Module Chassis Ground (envelope or case) **must** never be connected to clean ground connection.

Antenna cable shield should be designed to drain at one end of the shield while the other shield end remains open.

Antenna base mount grounding requires ground draining. Assure Radio Module isolation from all chassis grounds.

All communication cabling **shall** be packaged 200mm +/-25mm away from all inductive loads (ignition circuits, motors, actuators, solenoids, relays, nodes, etc.)

Remote communication stations when affixed to the cab or frame **shall** not rely on attachment hardware to provide chassis ground.

The requirements of Communication Equipment Requirements are to be shared with downstream customers not limited to Intermediate manufacturers, final stage manufacturers, Dealer/Distributor, and retail customers for the prevention unwanted noise and video distraction through ground looping caused by improperly installed communication equipment to the ground system of the electrical distribution system.

6.0 CLIMATE CONTROL



CLIMATE CONTROL



Always check operation and adjust louvers prior to driving the truck.

Your truck may be equipped with one of the following types of HVAC system:

1. A dual overhead HVAC system
2. A single overhead HVAC system
3. A single overhead heater/defroster system
4. A tunnel mounted HVAC system

In addition to the systems listed above your vehicle may also be equipped with a variety of auxiliary heating units typically located on the floor or under seats.

DUAL OVERHEAD HVAC SYSTEM

Control Head

A NON-Multiplexed system includes a control head, typically mounted in the “switch console center” in reach of the driver and officer. Refer to FIG. 6-1.

A multiplexed system can be accessed and controlled through the Vista display instead of using the control head. Refer to section 5 V-Mux page 67.

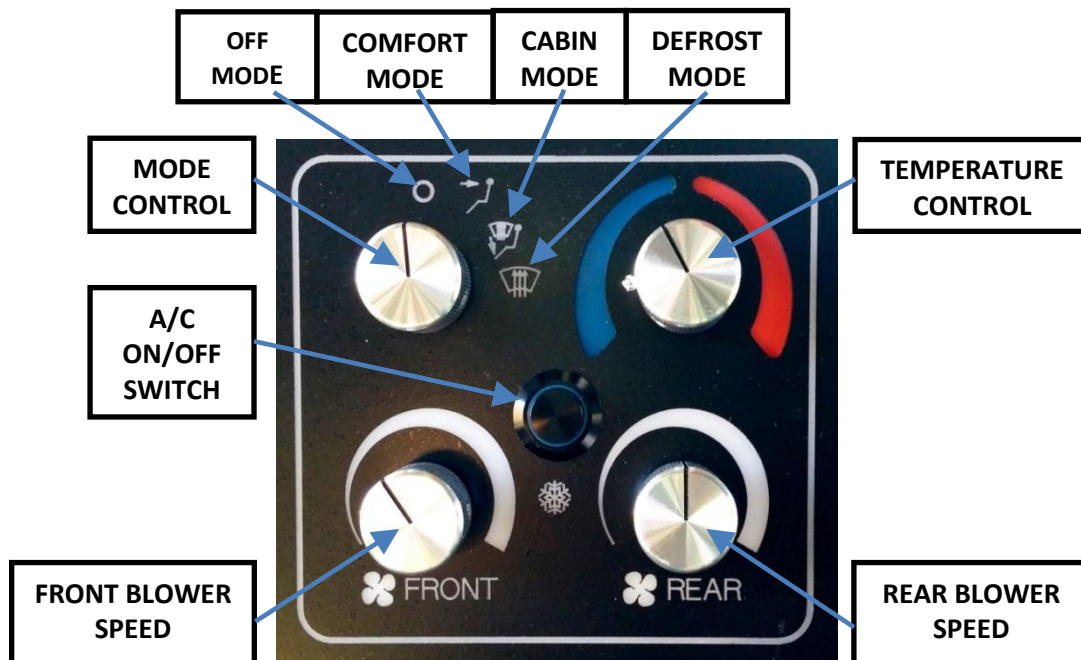


FIG. 6-1

Set the “mode control switch” to “comfort” mode for cab heating and cooling.

Set the “mode control switch” to “defrost” mode for windshield defrosting/defogging need. Even in this mode, 2 (two) vents will remain on for cab heating and cooling.

Set the “mode control switch” to “cabin” mode and this will split the airflow evenly between “comfort” mode and “defrost” mode.

The temperature control switch allows user to adjust temperature between hot and cold.

The “rear” blower speed control switch allows operator to control blower speed independent of front blower.

The “front” blower speed control switch allows operators to control blower speed independent of rear blower.

The A/C switch located in center of switch cluster allows operator to activate or deactivate the A/C compressor. When the blue ring around switch is lit this indicates compressor is on.

NOTE: When in defrost or cabin air modes, air is directed toward the windshield to prevent fogging; A/C is also commanded active to dry the air inside the cabin.

Filter Access

Intake filters may be removed for cleaning and are located behind removable panels in both front and rear covers. Refer to FIG. 6-2.

These filters can be removed and cleaned with soapy water.

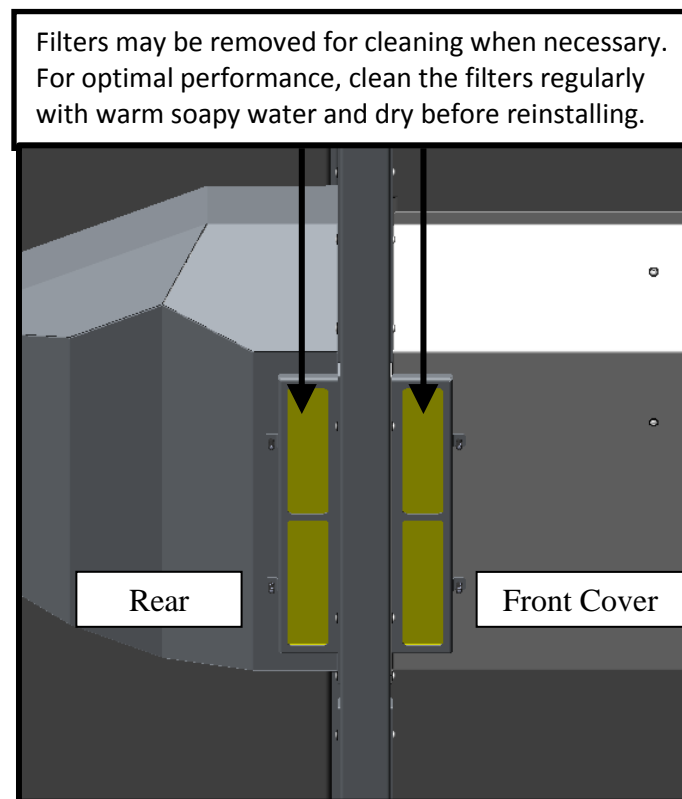
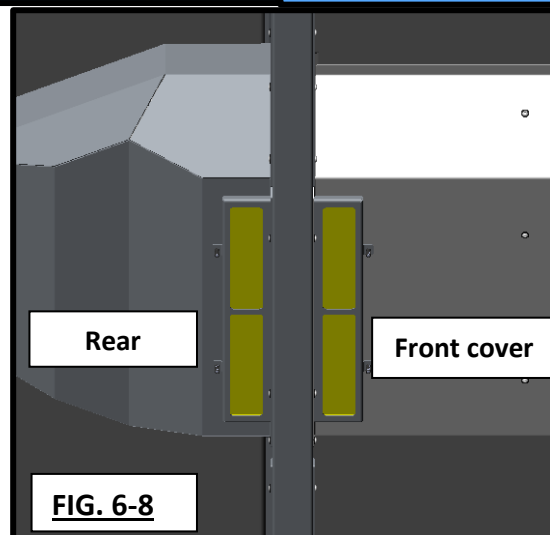
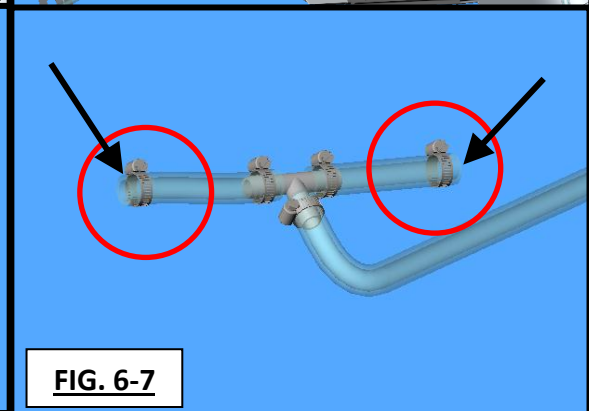
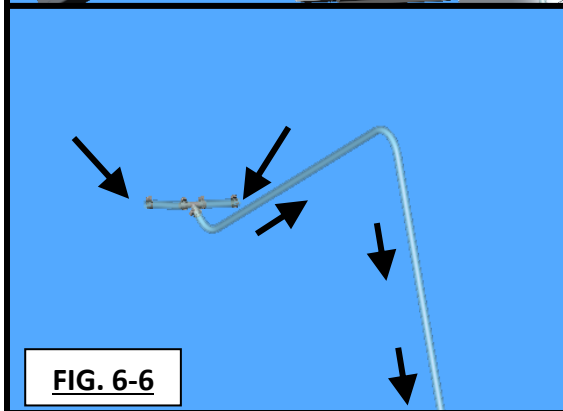
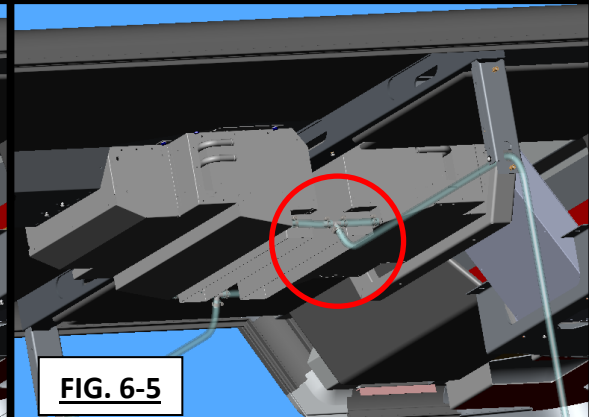
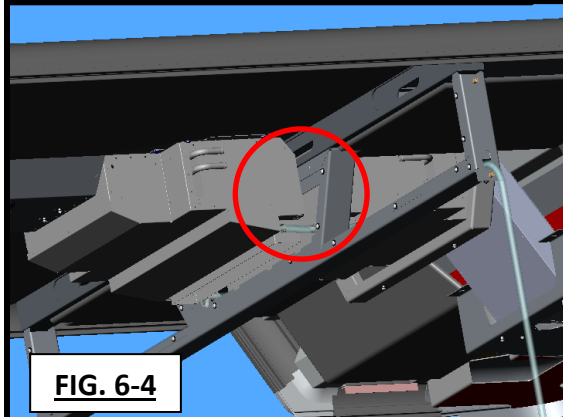
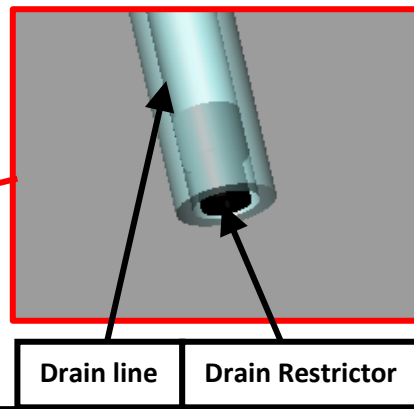
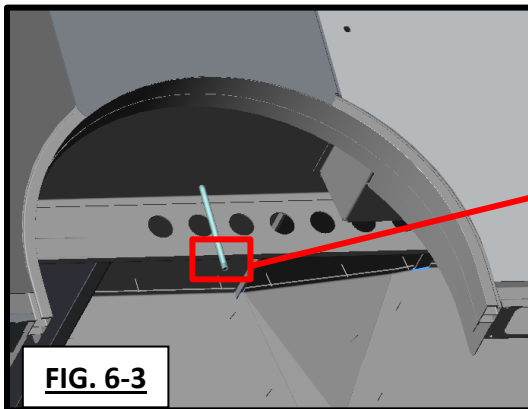


FIG. 6-2

Condensate Drain Lines

Raised roof vehicles equipped with dual overhead HVAC units have 2 (two) condensate drain lines. The LH drain line runs from ceiling mounted evaporators along the LH upper cross member to the LH B-Pillar, then down through B-Pillar (refer to FIG. 6-4 & 6-5) and out bottom of vehicle, just inboard of the LH front wheel (refer to FIG. 6-3). The RH drain line is symmetrically opposite and exits inboard of RH front wheel. It is very important that both drain lines remain clean, open, and free from debris buildup. This document describes recommended procedure for cleaning drain lines. It is also recommended that this cleaning procedure is to be utilized every 12 months (customers in hot and humid environments may need to clean the condensate drain lines more frequently than every 12 months).



1. Locate LH drain line and restrictor. This is located just inboard of the LH front wheel. Refer to FIG. 6-3.
2. Remove restrictor from drain line and retain for reuse.
3. Remove both front and rear HVAC covers. Refer to FIG. 6-8. This will allow access to evaporators and top of drain lines. Refer to FIG. 6-4 and FIG. 6-5. Some structure has been removed from FIG. 6-5 for clarity.
4. Loosen the two (2) hose clamps indicated in FIG. 6-7 and carefully pull the drain lines off the evaporator drain pans.
5. Apply 40-60 PSI/275.8-413.7 kPa shop air to one of the open ends of the drain line while plugging other end (refer to FIG. 6-7) this will clear out drain line. Then apply same 40-60 PSI/275.8-413.7 kPa shop air previously plugged end while plugging the opposite end. Refer to FIG. 6-6 for airflow direction. **Note: Placing a bucket under vehicle at drain line exit location will catch any and all debris.**
6. Once drain line is clean, reassemble drain line onto the evaporator drain pan and tighten hose clamps using an appropriate clamp force.
7. Locate the LH drain line described in steps 1 & 2 and re-install drain line restrictor. Refer to FIG. 6-3.
8. Follow steps 1 thru 7 on the RH drain line.
9. It is recommended that the A/C unit is run for several minutes prior to reinstalling the HVAC covers to ensure that condensate passes thru drain line and exits vehicle without connection points leaking.
10. Re-install front and rear HVAC covers. Refer to FIG. 6-8.



Always check operation and adjust louvers prior to driving the truck.

SINGLE OVERHEAD HVAC SYSTEM

To adjust air speed, rotate the blower control switch(s) to low, medium, or high fan speed. Louvers can be adjusted as necessary to direct the airflow. Refer to FIG. 6-9.

Control Head

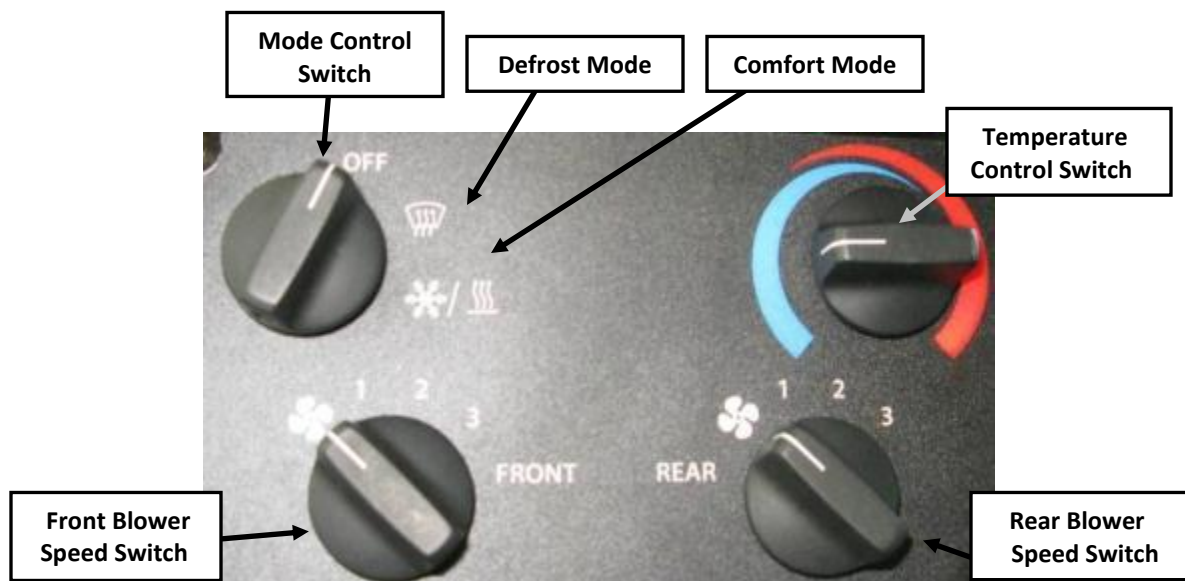


FIG. 6-9

Choose "Defrost" Mode for windshield Defrosting/Defogging need. For best performance for Defrost/Defog set temperature setting at maximum and front fan speed at maximum. Rear fan speed can be selected as desired. Defrost mode will deliver air via Defrost louvers however comfort louvers will be inactive. Refer to FIG. 6-9.

"Comfort" mode delivers air via comfort louvers however defrost louvers will be inactive.

Defrost louvers are fixed to position so the guide vanes are delivering air to the windshield. Refer to FIG. 6-9.

Filter Access

Filter may be removed for cleaning when necessary.
For optimal performance, clean filter regularly with warm
Soapy water and dry before reinstalling.



Headliner Center Section Shown

FIG. 6-10

HVAC Venturi Drain Maintenance (If Equipped)

Vehicles equipped with an overhead HVAC unit have two methods of condensate management. One method utilizes a "venturi pump" as depicted in FIG. 6-13. It is very important that the drain lines remain clean, open, and free from any debris buildup. This document describes the recommended procedure for cleaning the venturi drain style only. It is also recommended that this cleaning procedure is to be utilized every 12 months (customers in hot and humid environments may need to clean the condensate drain more frequently than once every 12 months).

1. Remove the air intake filter from the overhead HVAC cover. This will allow access to the drain line, white plastic fitting, and drain pan. For clarity, FIG. 6-11 shows the entire cover removed.
2. Carefully loosen the white plastic fitting.
3. Gently pull the drain line out of the white plastic fitting.



Drain Line

FIG. 6-11



White Plastic Fitting

4. Carefully loosen the brass fitting located on the venturi pump. The venturi pump is located behind the cab grille as depicted in FIG. 6-12. The grille may be removed or the cab may be tilted (refer to FIG. 6-13 for pump viewed with cab tilted) for ease of access. This fitting should be a "1/4-1/2 turn" over hand tight. If you are unable to loosen by hand, two wrenches may be used. Take great care when using wrenches so you **do not** damage the venturi pump.

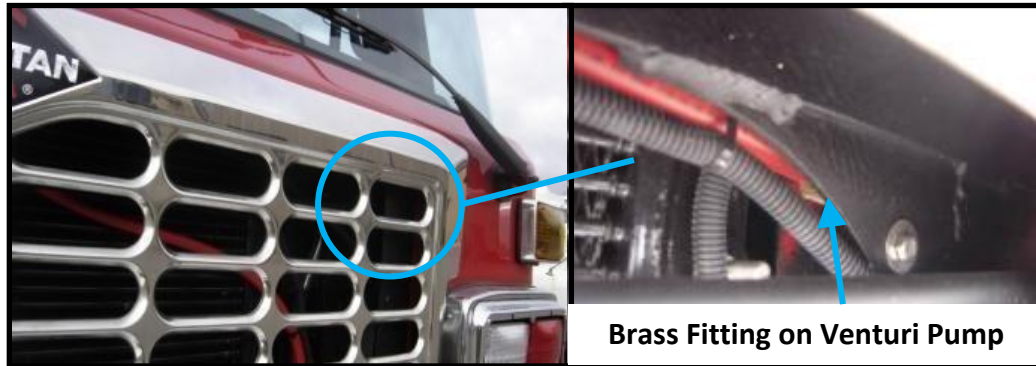


FIG. 6-12

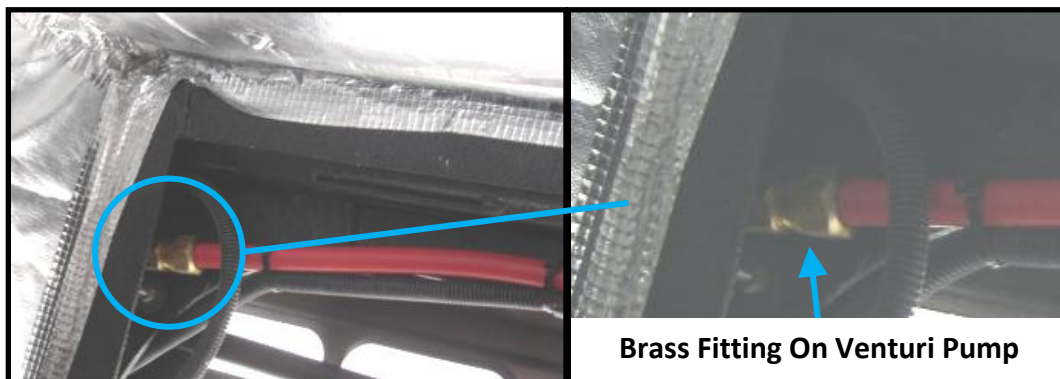


FIG. 6-13

5. Gently pull the drain line out of the brass fitting on the venturi pump, and then push thru the grille refer to FIG. 6-12 & 6-13.
6. Apply 40-60 PSI shop air to the end of the drain line located in the cab described in sections 1 thru 3. This will clear out the drain line. **Note: Placing a bucket under the drain line located in the grille area will catch any and all debris.**
7. Once the drain line is clean, reassemble the drain line into the white plastic fitting in the cab FIG. 6-11 and tighten 1/4-1/2 turn past hand tight. If using wrenches to tighten, take great care not to damage the drain pan.
8. Reassemble the drain line into the brass fitting on the venturi pump and tighten 1/4-1/2 turn past hand tight. If using wrenches to tighten, take great care not to damage the venturi pump. Refer to FIG. 6-12 & 6-13.
9. **If the cab has been tilted for access, you must lower the cab at this point.**
10. It is recommended that the A/C unit is run for several minutes prior to installing the HVAC cover or intake filter to ensure that condensate passes thru both fittings and exits the vehicle without the fittings leaking.
11. Re-assemble the air intake filter and/or HVAC cover.

HVAC Gravity Drain Maintenance (If Equipped)

Vehicles equipped with an overhead HVAC unit have two methods of condensate management. The second method utilizes a “gravity drain” as depicted in FIG. 6-11 above. It is very important that the drain lines remain clean, open, and free from any debris buildup. This document describes the recommended procedure for cleaning the gravity drain style only. It is also recommended that this cleaning procedure is to be utilized every 12 months (customers in hot and humid environments may need to clean the condensate drain more frequently than once every 12 months).

1. Remove the air intake filter from the overhead HVAC cover. This will allow access to the drain line, white plastic fitting, and drain pan. For clarity, FIG. 6-11 above shows the entire cover removed.
2. Carefully loosen the white plastic fitting. This fitting should be a "1/4-1/2 turn" over hand tight. If you are unable to loosen by hand, two wrenches may be used. Take great care when using wrenches so you **do not** damage the drain pan.
3. Gently pull the drain line out of the white plastic fitting.
4. Apply 40-60 PSI shop air to the end of the drain line. This will clear out the drain line. **Note: Placing a bucket under the vehicle at the drain line exit location will catch any and all debris.**
5. Once the drain line is clean, reassemble the drain line into the white plastic fitting and tighten 1/4-1/2 turn past hand tight. If using wrenches to tighten, take great care not to damage the drain pan.
6. It is recommended that the A/C unit is run for several minutes prior to installing the HVAC cover or intake filter to ensure that condensate passes thru the fitting and exits the vehicle without the fitting leaking.
7. Re-assemble the air intake filter and/or HVAC cover.

SINGLE OVERHEAD HEATING/DEFROSTER SYSTEM

Optional defroster fans are not shown. Refer to FIG. 6-14

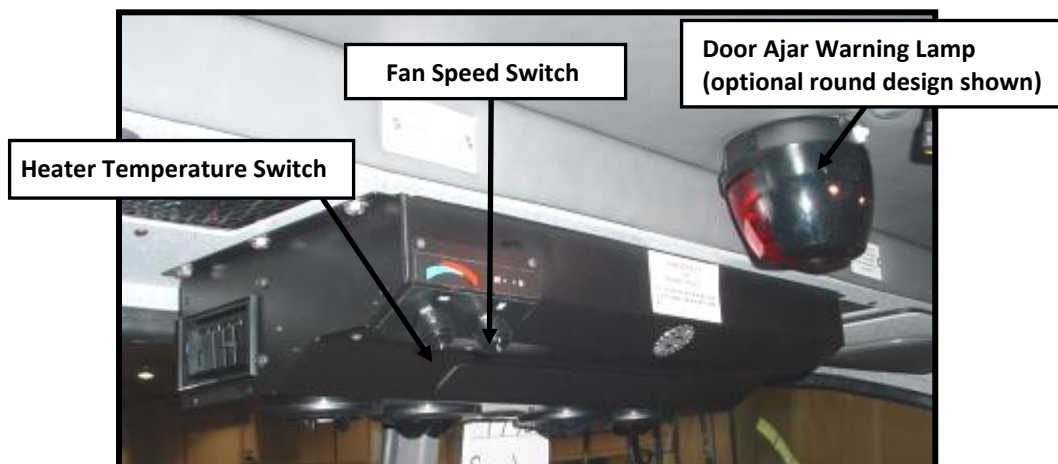
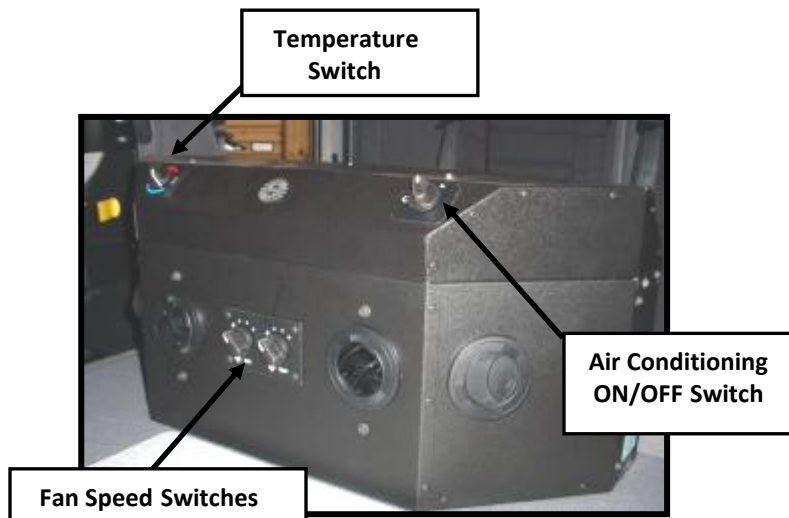


FIG. 6-14

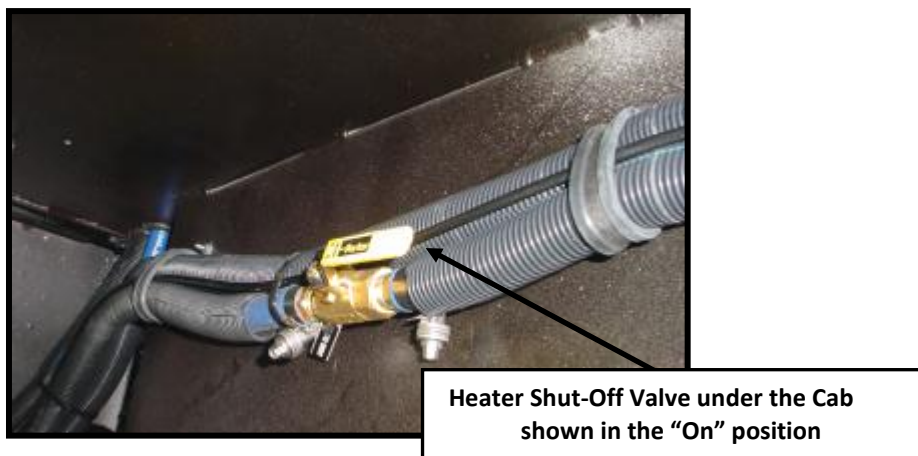
For best performance for Defrost/Defog set temperature setting at maximum and fan speed at maximum on the overhead front controls and heater.

TUNNEL MOUNTED HVAC SYSTEM



ADDITIONAL AUXILIARY HEATER SYSTEMS HAVE SHUT-OFF VALVE

NOTE: A seasonal hot water shut-off valve (located under the cab, behind the passenger step, above the air cleaner) must be turned off by rotating the lever 90° during warm weather when air conditioning is required.



7.0 POWERTRAIN



POWERTRAIN

The power train of this vehicle is equipped with certain components that may be warrantable against defects or mis-builds for a period of five years, 100,000 miles, or 3,000 engine hours, whichever occurs first. If a defect or mis-build is identified in components in the power train, contact Spartan Customer & Product Support at 800-543-5008.

CAUTION

Throughout the manual the term “routinely”, used in regards to maintenance, refers to intervals based on use/location of the individual emergency response cab and chassis.

GENERAL INFORMATION

This Spartan cab and chassis was provided with engine and aftertreatment technology that are required to meet emissions from mobile sources Environmental Protection Agency (EPA) / California Air Resources Board (CARB) requirements. It was engineered, tested, and certified in accordance with strict installation, performance, and regulatory requirements imposed by the Federal government as well as component manufacturers. Modifications to the power train, or its associated systems, may directly affect safety, reliability, or performance. Certain modifications may lead to noncompliance to governmental regulations and are prohibited without prior approval from Spartan Engineering and the engine manufacturer. Additionally, any custom bodywork or equipment mounted to the cab and chassis in the vicinity of the power train or related components may provide similar detrimental effects and are also prohibited without prior approval from Spartan Engineering. Failure to comply may result in the voiding of warranties and the occurrence of an emissions noncompliance event that may be considered tampering and punishable by the assessment of penalties by the EPA and CARB, as well as the need for remedial measures.

Engine/Emissions

The primary function of the engine is to work in conjunction with the transmission and other drive train components to produce and transmit power to the wheels for vehicle movement. Secondary functions include providing power to auxiliary components and systems such as hydraulic pumps, water pumps, etc.

This Spartan cab and chassis utilizes an engine that meets current emissions regulations. Engine technology used to meet current emissions requirements for NOx reduction focuses on two additional strategies: Selective Catalytic Reduction (SCR) and Advanced Exhaust Gas Recirculation (Advanced EGR). The SCR strategy uses exhaust aftertreatment in addition to conventional EGR to reduce NOx emissions before it exits the tailpipe. The Advanced EGR strategy uses in-cylinder management solely to reduce NOx emissions before it exits the engine.

The engine installation is certified with the engine manufacturer to meet all performance requirements and government regulations. Modifications to the engine and related system are strictly prohibited without approval from Spartan Engineering and the engine manufacturer.

Exhaust/Aftertreatment

The primary function of the the aftertreatment system is to filter exhaust gases from the engine before it is dispersed into the atmosphere.

This Spartan cab and chassis utilizes various exhaust/aftertreatment configurations that meet the current emissions regulations. Please contact Spartan Engineering for questions regarding all possible exhaust/aftertreatment configurations.

The exhaust installation is certified with the engine manufacturer to meet all performance requirements and government regulations. Modifications to the exhaust system are strictly prohibited without approval from Spartan Engineering and the engine manufacturer.

Cooling System

Primary function of the cooling system is to dissipate the heat generated by the engine, transmission, and other auxiliary components. SCR emissions engines also utilize the cooling system as a heat source in cold weather climates for proper emissions functions.

This Spartan cab and chassis utilizes a charge air cooler (CAC) and a radiator cooler configuration to meet the cooling requirements of the engine. Additionally, a transmission cooler is oriented in the coolant loop to meet the cooling requirements of the transmission.

The cooling system installation is certified with the engine manufacturer to meet all engine performance and associated emissions requirements. Cooling system performance can be effected by changes in bodywork and/or equipment mounted to the chassis cab unit. Modifications to the chassis cab, which may impact air flow or otherwise hinder cooling system performance are strictly prohibited without prior approval from Spartan Engineering and the engine manufacturer.

ENGINE

CAUTION

Modifications to the engine, engine systems or related components, engine fuel system, fuel tank plumbing or surrounding areas, engine lubrication system, engine/accessory drive system, and or engine air intake system are strictly prohibited without approval from Spartan Engineering and the engine manufacturer. Modifications may result in loss of performance, emissions compliance violations and/or void warranty.

The engine manufacturer's Owners Manual **must** be referred to for all general engine operations and maintenance requirements. The engine manufacturer's service and/or operations and maintenance documentation **must** be referred to for all service procedures to be performed. In addition to engine manufacturer's documentation, the following information is provided for common engine system operation and maintenance.

Fuel System

Dependable operation of the engine requires a properly designed fuel system and a source of clean fuel meeting engine manufacturer requirements.

Fuel Type

Fuel is the fluid used in diesel engines to promote combustion and produce power. Proper fuel type is critical to the operation of the engine. Refer to the engine manufacturer's documentation for proper selection, cautions, and warnings regarding fuel type.

Fuel Maintenance

Fuel cleanliness is critical to the performance and longevity of the engine. Refer to the engine manufacturer's documentation for intervals required to drain water in fuel, intervals to maintain fuel filters, and procedures for safely servicing the overall fuel system.

CAUTION

Running an engine without fuel or with restricted fuel flow may result in loss of performance and engine damage.

CAUTION

Do not overfill fuel tank.

Fuel Priming

Fuel priming may be necessary after filter changes, running out of fuel, maintenance, etc. Fuel priming options may include engine pump, non-engine manual pump, non-engine electric pump, etc.

CAUTION

Starting the engine without a properly primed fuel system may result in engine damage.

Fuel Tank

The fuel tank mounting and location was designed to accommodate removal from the vehicle.

Fuel Cooler (If Equipped)

Fuel coolers may be present in a fuel system to maintain proper fuel temperatures to the engine. The typical mounting location for the fuel cooler is at the rear of the vehicle near the fuel tank.

CAUTION

Fuel temperatures may elevate if obstructions are added near the fuel cooler, contaminants are allowed to collect on the fuel cooler or damaged cooling fins exist. Fuel temperatures beyond the maximum operating temperatures may result in loss of performance and engine damage.

Regular inspection of the fuel cooler is necessary for overall performance of the fuel system. The fuel cooler should be maintained so the cooling grid is clean and free of contaminants, otherwise fuel overheating may occur. Clean, low pressure water flushed through the cooling fins, and a soft brush to remove debris is recommended for cleaning.

CAUTION

The use of high pressure air, high pressure water and/or caustic cleaning solutions may damage the fuel cooler causing premature failure or fuel overheating.

Lubrication System

Reliable operation of the engine requires a properly maintained engine lubrication system.

Lubrication Type

Engine oil is the fluid that lubricates internal engine components during engine operation. Proper engine oil is critical to the performance and durability of the engine. Refer to the engine manufacturer's documentation for proper selection, cautions and warnings. Refer to the data label above the sun visor for fluid type and quantity as provided by Spartan.

Lubrication Maintenance

Regularly maintained oil and filters are critical to the performance and durability of the engine. Refer to the engine manufacturer's documentation for intervals required to check/maintain the oil level, intervals to change engine oil and filters, and procedures for safely servicing the oil system.

Lubrication Dipstick

Engine oil dipstick is used to check oil level to engine requirements. The dipstick handle is typically yellow and can be located in various locations based on application, ranging from access under the cab to remote access through a hatch.

Lubrication Electronic Level Sensor

In applications where engine oil dipsticks cannot be accessed without tilting the cab, electronic oil level sensors are installed in the oil pan and indicate through diagnostics when the engine oil level is low and requires additional oil. This oil level sensor location may not correlate exactly with the add mark on the dipstick, but is approved by the engine manufacturer for electronic oil low level sensing.

Lubrication Fill Port

Engine oil fill port is used to add oil as needed to bring the oil level on the dipstick to proper operating range. The engine fill port can be located in various locations based on application, and can range from access under the cab to remote access through a hatch.

Engine/Accessory Drive System

The drive system allows for engine components (such as waterpump) and accessory components (such as air conditioning compressor) to operate properly.

Drive Belt Maintenance

Belts used to drive engine and accessory components **must** be properly maintained for dependable operation. Cracks, glazing, tears, cuts, and excessive wear found during inspection will indicate when belts **must** be replaced. Refer to the engine manufacturer's documentation for belt inspection intervals, tension inspection intervals, and procedures to service and maintain the drive belts. Drive belt routing schematics are provided in documentation for each vehicle. If drive belt replacement is necessary, original replacement parts are required to avoid possible operational defects.

Drive Component Maintenance

Pulleys, idlers, tensioners, and other drive components **must** be properly maintained for dependable operation. Pulley damage, improper belt tracking/alignment, improper belt tension, etc. found during inspection may indicate component maintenance is needed. Refer to the engine manufacturer's documentation for intervals required to inspect belt tension, inspect component condition, and procedures to service/maintain the drive components. If drive component replacement is necessary, original replacement parts are required to avoid possible operational defects.

Air Intake System

Provides a means for clean, temperature regulated air to enter the engine. Typical air intake systems (Refer to FIG. 7-1) consist of all components from the intake of external air up to the turbocharger.

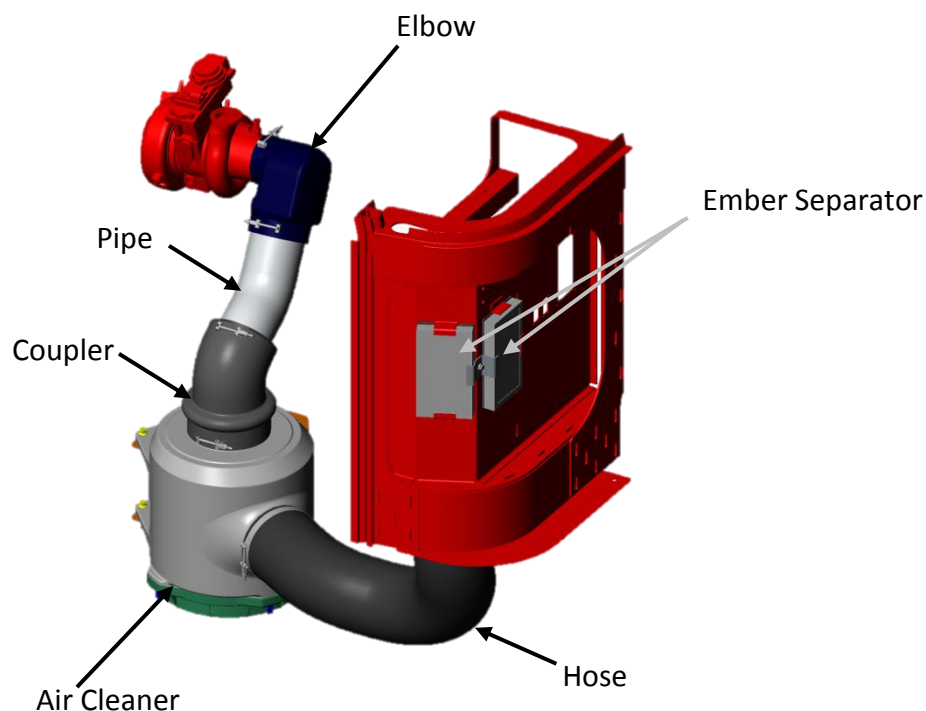


FIG. 7-1
Typical Air Intake System

External Air Inlet

Typical inlet passages include locations in the headlight bezel, grill, front tunnel wall, etc. to allow external air to enter the air intake system. The passages are designed for air restriction minimization, moisture removal, and temperature control.

CAUTION

Unacceptable engine inlet air quality, temperature or restriction may occur if changes are made to the external passages and/or if obstructions and contaminants are allowed to collect. Air quality, temperature or restriction beyond the maximum operating limits may result in loss of performance and engine damage.

WARNING

Do not use ether, propane, gasoline, or other starting aids when starting the engine. Serious personal injury can result from using starting aids.

The air inlet passages **must** be inspected regularly to remove foreign material that restrict air movement into the air intake. Additionally, air recirculation shields, and seals, located in the passages **must** be inspected regularly, and maintained to control air inlet temperature by restricting the intrusion of hot air under the cab, back into the engine.

Ember Separator

The ember separator is a mesh screen that traps hot embers and allows them to extinguish prior to reaching the air filter. It is located behind the officer side headlight and accounts for a minimum inlet air restriction.

WARNING

The removal, unapproved replacement, allowed obstruction, and/or contamination of the ember separator may result in loss of performance and engine damage. Hot embers reaching the air filter may result in a fire.

The ember separator **must** be inspected regularly and routine cleaning may be required in high dust/debris environments to remove obstructions or contaminants. Additionally, the ember separator seals **must** be regularly inspected to ensure that they are not being bypassed. If replacement is necessary, original replacement parts are required to avoid restriction issues.

Air Cleaner

The vehicle may have either a replaceable air cleaner or an air cleaner with replaceable filter element housed in a canister, and provides maximum protection against contaminated air entering the engine. The air cleaner is located under the cab on the officer side.

CAUTION

Replacement with unapproved air cleaners or filter elements, and/or contamination of the turbo inlet or air cleaner during replacement may result in loss of performance and engine damage.

CAUTION

Fording water and running over debris may cause damage to the air cleaner and loss of performance as well as engine damage. Punctures, or seal damage, may allow contaminant to enter the engine and cause serious damage.

When air cleaner or filter element replacement is necessary, original replacement parts are required to avoid filtration performance and/or restriction issues. The air cleaner canister **must** be inspected regularly for damage, at which time damage assessment may require replacement. Canister damage such as seal failure and punctures require immediate replacement and assessment of further engine damage. Additionally, excessive air filter restriction is indicated with a warning light on the instrument panel cluster requiring replacement of the air cleaner. Failure to replace a clogged air cleaner may result in loss of performance and engine damage. Air cleaner mounting bracketry and hardware **must** be routinely inspected and maintained for reliable mounting.

Air Intake Plumbing

Air inlet plumbing consists of tubes, couplers, hoses, elbows, and clamps necessary to move fresh air from the ember separator through the air cleaner into the turbo. Regular inspection and maintenance of the plumbing is necessary for overall performance of the air intake system. Clamps **must** be routinely inspected to ensure joints between components are tight to prohibit leaks and contamination. Tubes, couplers, hoses, and elbows **must** be routinely inspected for cracks, wear points, loose connections or punctures that can cause leaks. Failure to replace a damaged plumbing component may result in loss of performance and engine damage.

COOLING SYSTEM

CAUTION

Modifications to the chassis cooling systems, engine cooling systems, auxiliary coolant (outside of what is provided with this chassis), charge air cooling system, airflow system, and/or transmission cooling system are strictly prohibited without approval from Spartan Engineering and the engine manufacturer. Modifications may result in loss of performance, emissions compliance violations, and/or void warranty.

The cooling system provides a means to dissipate heat produced by the engine and transmission, allowing them to operate at acceptable temperatures. Cooling systems include engine cooling, charge air cooling, and transmission cooling. FIG. 7-2 illustrates a typical cooling system.

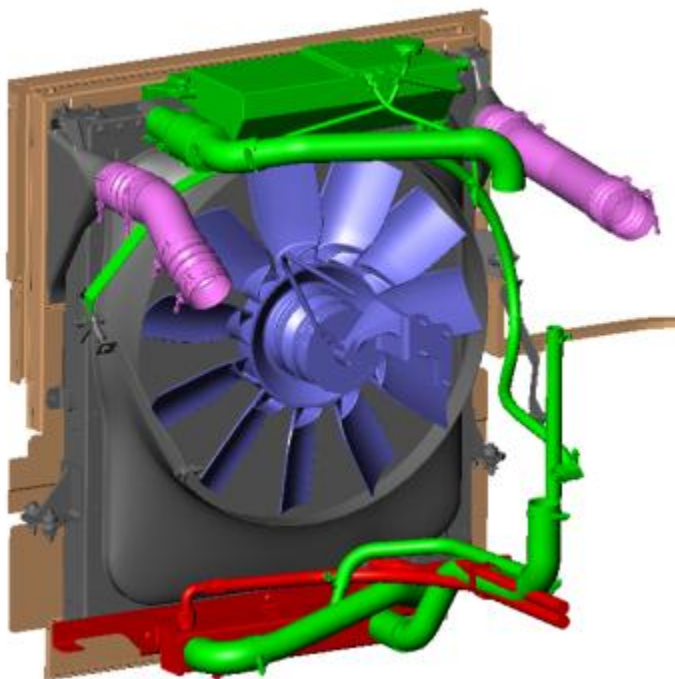


FIG. 7-2
Typical Cooling

Engine Cooling System

A properly designed and maintained engine cooling system is critical to the durability and performance of the engine. Internal combustion engines create heat during operation as fuel is ignited during the combustion process. The engine cooling system (Refer to FIG. 7-3) removes heat from the engine and transfers it to the atmosphere through a complex arrangement of components to ensure reliable engine operation.

The engine manufacturer's Owners Manual, service and/or operations, and maintenance documentation **should** be referred to for all engine cooling systems operations, maintenance requirements, and service procedures to be performed. In addition to engine manufacturer's documentation, the following information is provided for Spartan cab and chassis engine cooling system operation and maintenance.

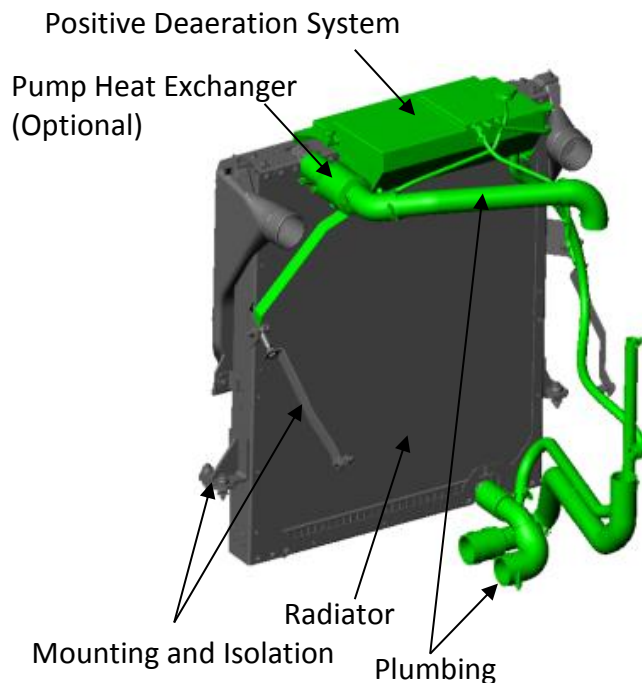


FIG. 7-3
Typical Engine Cooling System

Coolant Type

Coolant is the fluid that transfers the heat from the engine's components to the radiator for dissipation of heat to the atmosphere. Proper coolant is critical to the performance and durability of the engine. Refer to the engine manufacturer's documentation for proper selection, cautions and warnings. Refer to the data label above the sun visor for fluid type and quantity as provided by Spartan.

CAUTION

The use of non-approved coolant types for the engine or improper coolant mixtures for the operating environment may result in engine damage.

CAUTION

Mixing coolant types may result in engine damage. If changes to the coolant type is needed a coolant flush is recommended.

Coolant Maintenance

Regularly maintained coolant and filters are critical to the performance and durability of the engine. Refer to the engine manufacturer's documentation for intervals required to check/maintain the coolant level, intervals to flush coolant, change filters, and procedures to service the coolant system. Coolant level checking is completed at the surge tank sight glass. Coolant level filling is completed at the surge tank pressure cap. Drain ports are located at the bottom of the radiator and transmission cooler to remove the majority of the coolant. Coolant flushes may require the removal of plumbing to ensure all fluid is removed. If the coolant sensor is to be removed for maintenance purposes, the sensor **shall** be reinstalled as follow: Hand tighten, and use the hex area of sensor and torque to 26 in. lbs. (+/- 1 in. lbs.), then torque clock the sensor 1/2 to 3/4 of a turn so that the 3-pin connector is in vertical position. After refilling the reservoir verify there are no leak paths.

CAUTION

Mixing coolant types may result in engine damage. If changes to the coolant type is needed a coolant flush is recommended.

CAUTION

Failure to maintain appropriate engine coolant mixture could result in emissions critical component failure.

CAUTION

Navistar MF13 engines (if equipped) require ignition on (DO NOT START ENGINE) during coolant fill, after system empty, to ensure proper coolant fill.

WARNING

Electric shock is possible when performing maintenance with the ignition on. Serious personal injury can occur from electrical shock.

WARNING

Coolant is toxic. Keep away from children and pets. If not reused, dispose of in accordance with local environmental regulations.

WARNING

Coolant components and other engine components can be very hot if serviced shortly after operation. Serious personal injury can occur if hot components are touched.

WARNING

Never remove radiator cap while coolant is hot. Remove cap slowly when coolant is at ambient temperature. A sudden release of pressure from a heated cooling system can result in serious personal injury from burst of hot coolant.

Positive Deaeration System

The surge tank and associated components (Refer to FIG. 7-4) are utilized to indicate low coolant level, provide positive coolant pressure to the engine water pump, remove air from the coolant, and allow for coolant expansion and recovery.

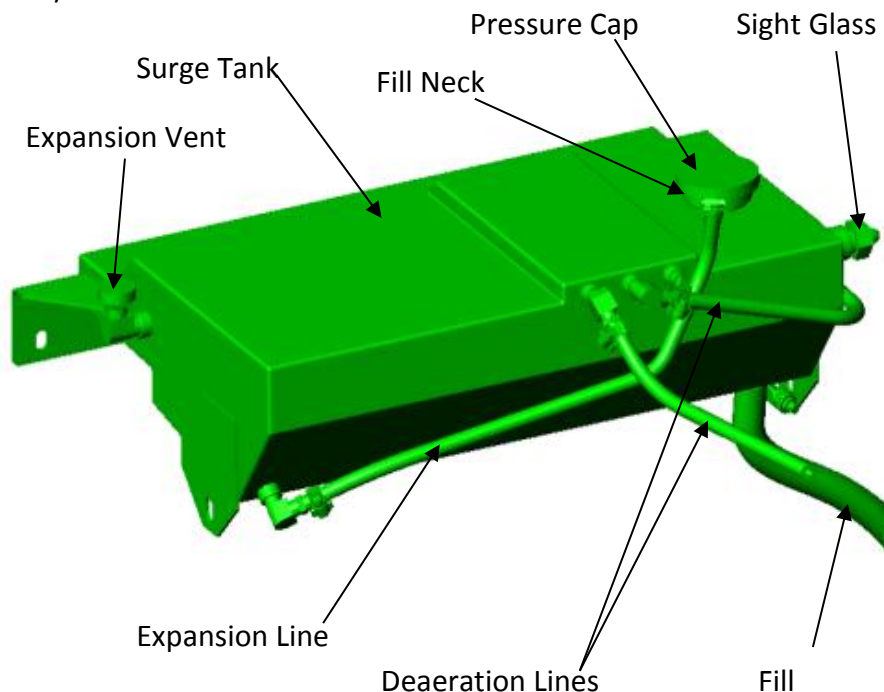


FIG. 7- 4
Typical Positive Deaeration System

Surge Tank

The surge tank is designed to contain both a pressure and expansion chamber (Refer to FIG. 7-5). The pressure chamber contains the coolant full level when the system is not under pressure due to high temperature. As the coolant temperature and pressure rises, coolant is allowed out the fill neck by the pressure cap through the expansion line and into the expansion chamber. When the coolant temperature and pressure decreases, the coolant is then drawn back through the expansion line back into the pressure chamber to maintain a full system.

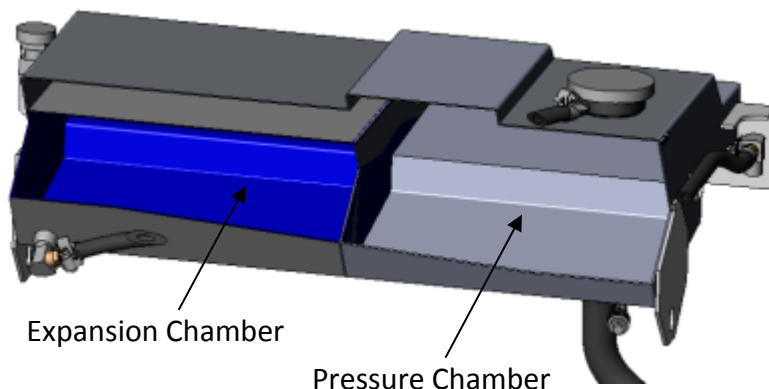


FIG. 7-5
Typical Surge Tank Cutout

Coolant Sight Glass

A sight glass is located on the surge tank, indicating the physical coolant level. If coolant is not visible in the sight glass, coolant fill is required.

Coolant Low Level Indicator

An electronic indicator is located on the surge tank, indicating the low coolant level. A low coolant level is indicated with a warning light on the instrument panel cluster requiring coolant maintenance. Failure to maintain the proper coolant level may result in loss of performance and engine damage.

Deaeration Lines

Deaeration lines are routed from high points on the engine and radiator to the surge tank, allowing trapped air to be removed from the coolant during maintenance flushes and normal operation. Regular inspection and maintenance of the deaeration lines is necessary for overall performance of the cooling system. Clamps and fittings **must** be routinely inspected to ensure joints between components are tight to prohibit leaks. Hoses **must** be routinely inspected for cracks, wear points, loose connections or punctures that may cause leaks. Failure to replace any damaged deaeration lines may result in loss of performance and engine damage.

Coolant Fill Neck

The fill neck is located on the surge tank, allowing for coolant level maintenance, and allowing expansion and recovery of coolant during normal operation through the expansion line. Fill necks **must** provide proper sealing to the pressure cap. Refer to the engine manufacturer's documentation for intervals required to inspect the pressure cap sealing capability while installed on the surge tank fill neck. Improper pressure cap sealing can result in loss of coolant and may result in loss of performance and engine damage.

Coolant Pressure Cap

A dual seal pressure cap is located on the surge tank fill neck, allowing for coolant level maintenance, expansion, and recovery of coolant during normal operation. Pressure caps **must** be properly maintained for dependable operation. Pressure caps outside of proper pressure specification, cracks on the rubber seals, or improper sealing to the surge tank found during inspection will indicate the pressure cap **must** be replaced. Refer to the engine manufacturer's documentation for intervals required to inspect the pressure cap seals,

procedures to test the pressure cap's rated pressure capability, and sealing capability while installed on the surge tank. If pressure cap replacement is necessary, original replacement parts are required to avoid operational issues. An incorrect or malfunctioning pressure cap can result in loss of coolant and may result in loss of performance and engine damage.

Coolant Expansion Line

The expansion line allows for coolant to travel between the pressure tank and expansion tank during normal operation. Regular inspection and maintenance of the expansion line is necessary for overall performance of the cooling system. Clamps and fittings **must** be routinely inspected to ensure joints between components are tight to prohibit leaks. Hoses **must** be routinely inspected for cracks, wear points, loose connections, or punctures that can cause leaks. Failure to replace any damaged or leaking expansion lines may result in loss of coolant and may result in loss of performance and engine damage.

Coolant Expansion Vent

A vent is located on the expansion chamber of the surge tank, allowing for expansion of coolant during normal operation. The vent **must** be inspected regularly and routine cleaning may be required in high dust/debris environments to remove obstructions or contaminants.

Coolant Fill Line

The fill line allows for coolant to migrate throughout the entire cooling system during filling operation. Pressurized coolant from the surge tank is provided to the pressure chamber then to the engine water pump in order to prevent pump cavitation during normal operation. Regular inspection and maintenance of the fill line is necessary for overall performance of the cooling system. To detect/or prevent leaks, clamps and fittings **must** be inspected for tightness. Hoses **must** be routinely inspected for cracks, wear points, loose connections or punctures that can cause leaks. Failure to replace any damaged or leaking fill lines may result in loss of coolant, reduced performance, and engine damage.

Radiator

The high temperature radiator is a critical component of the engine cooling system and is sized and configured to cool the engine properly. If equipped, an additional low temperature radiator is utilized to meet engine performance requirements. The engine pumps hot coolant into the radiator. As the hot coolant passes through the radiator, the engine fan draws ambient air through the radiator grid in turn transferring the heat from the coolant to the air. For this reason, the radiator is considered an air-to-coolant cooler. The coolant is then returned back to the engine to remove more generated heat and repeat the cycle. The typical mounting location for the radiator is behind the grill and in front of the engine fan.

CAUTION

Coolant temperatures may elevate beyond normal operating ranges if obstructions are added in front of the radiator, contaminants are allowed to collect on the radiator or damaged cooling fins exist. Coolant temperatures beyond the maximum operating temperatures may result in loss of performance and/or engine damage.

Regular inspection of the radiator is necessary for overall performance of the cooling system. The radiator **must** be maintained so the cooling grid is clean and free of contaminants, otherwise coolant overheating may occur. Clean, low pressure water flushed through the cooling fins, and a soft brush to remove debris is recommended for cleaning.

CAUTION

The use of high pressure air, high pressure water, and/or caustic cleaning solutions may damage the radiator causing premature failure or excessive coolant temperatures.

Mounting and Isolation

The radiator is mounted to the chassis and isolated from shock and vibration. Regular inspection and maintenance of the mounting and isolation components is necessary for overall durability of the cooling system. Fasteners and brackets **must** be routinely inspected to ensure the cooling system is properly secured. Isolation components **must** be routinely inspected for cracks, wear points and loose connections that allow for excessive movement or interference during operation. Failure to replace any damaged mounting or isolation may result in failure of critical cooling system components.

Pump Heat Exchanger

Pump heat exchangers may be present in a cooling system to maintain proper engine coolant temperatures during pump mode operation. The typical mounting location for the pump heat exchanger is between the engine and the radiator coolant inlet. Water from the apparatus pump is routed through the pump heat exchanger during pump mode operation to provide additional cooling to the engine coolant. Pump heat exchanger ports and water lines **must** be configured so water is not allowed to freeze thus damaging the components. Routine inspection of the pump heat exchanger is necessary to check for adverse wear or failure. Failure to replace a damaged pump heat exchanger may result in loss of coolant or weakening of the coolant mixture resulting in loss of performance and/or engine damage.

Coolant Plumbing

Coolant plumbing consists of the tubes, hoses, and clamps necessary to move the coolant through the cooling system loop during engine operation. Regular inspection and maintenance of the plumbing is necessary for overall performance of the engine cooling system. Clamps **must** be routinely inspected to ensure joints between components are tight to prohibit leaks and contamination. Tubes and hoses **must** be routinely inspected for cracks, wear points, loose connections, or punctures that can cause leaks. Failure to replace a damaged plumbing component may result in loss of performance and engine damage.

Charge Air Cooling System

A properly designed and maintained charge air cooling system is critical to the durability and performance of the engine. Turbocharged engines elevate temperature and pressure of the intake air during the mechanical operation of the turbocharger. The charge air cooling system (Refer to FIG. 7-6) removes this heat from the intake air and transfers it to the atmosphere to ensure reliable engine operation.

The engine manufacturer's Owners Manual, service and/or operations and maintenance documentation should be referred to for all charge air cooling systems operations, maintenance requirements, and service procedures to be performed. In addition to engine manufacturer's documentation, the following information is provided for Spartan charge air cooling system operation and maintenance.

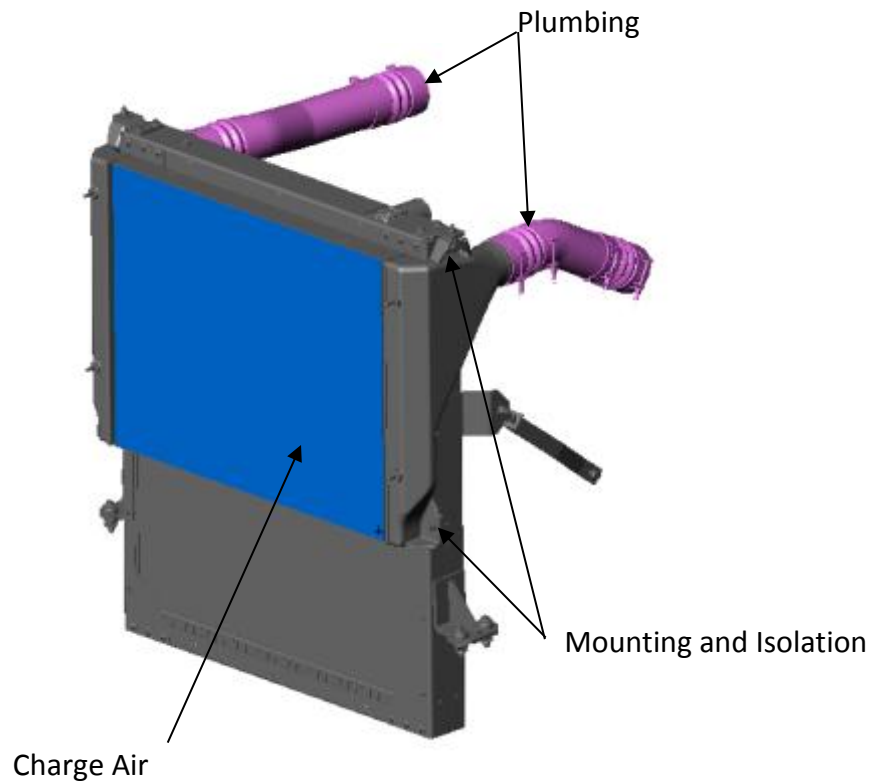


FIG. 7-6
Typical Charge Air Cooling System

Charge Air Cooler

The charge air cooler is an emissions critical component that is sized and configured to cool turbocharged air prior to being used by the engine. The turbocharger elevates the temperature and pressure of the clean air coming from the air cleaner. As the hot air passes through the charge air cooler, the engine fan draws ambient air through the charge air cooler grid in turn transferring heat from the internal air to the atmospheric air. For this reason, the charge air cooler is considered an air-to-air cooler. The cooled air is then returned back to the engine to be utilized during the combustion process. The typical mounting location for the charge air cooler is behind the grill and in front of the radiator.

CAUTION

Engine intake air temperatures may elevate if obstructions are added near the charge air cooler, contaminants are allowed to collect on the charge air cooler, or damaged cooling fins exist. Engine intake air temperatures beyond the maximum operating temperatures may result in loss of performance and engine damage.

Regular inspection of the charge air cooler is necessary for overall performance of the charge air cooling system. The charge air cooler **must** be maintained so the cooling grid is clean and free of contaminants, otherwise engine intake air overheating may occur. Clean, low pressure water flushed through the cooling fins, and a soft brush to remove debris is recommended for cleaning.

CAUTION

The use of high pressure air, high pressure water, and/or caustic cleaning solutions may damage the charge air cooler causing premature failure or intake air overheating.

CAUTION

Contamination of the charge air cooler during service or replacement may result in loss of performance and engine damage.

Mounting and Isolation

The charge air cooler is mounted to the radiator and isolated from shock and vibration. Regular inspection and maintenance of the mounting and isolation components is necessary for overall durability of the cooling system. Fasteners and brackets **must** be routinely inspected to ensure the cooling system is properly secured. Isolation components **must** be routinely inspected for cracks, wear points and loose connections that allow for excessive movement or interference during operation. Failure to replace any damaged mounting or isolation may result in failure of critical cooling system components.

Charge Air Plumbing

Charge air plumbing consists of the tubes, hoses, and clamps necessary to move the air from the turbo through the charge air cooler and into the engine air intake manifold. Regular inspection and maintenance of the plumbing is necessary for overall performance of the charge air cooling system. Clamps **shall** be routinely inspected to ensure joints between components are tight to prohibit leaks and contamination. Tubes and hoses **shall** be routinely inspected for cracks, wear points, loose connections or punctures that can cause leaks. Failure to replace a damaged plumbing component may result in loss of performance and engine damage.

CAUTION

Contamination of charge air plumbing during service or replacement may result in loss of performance and engine damage.

Airflow System

A clean, temperature regulated source of air into the radiator and charge air cooler are essential to proper operation. Additionally, the air **must** move efficiently through the coolers and properly dispense into the engine tunnel without preheating incoming air or stagnating in the tunnel. Typical airflow systems (Refer to FIG. 7-7 and 7-8) consist of all components needed to maintain the air source through the radiator and charge air coolers.

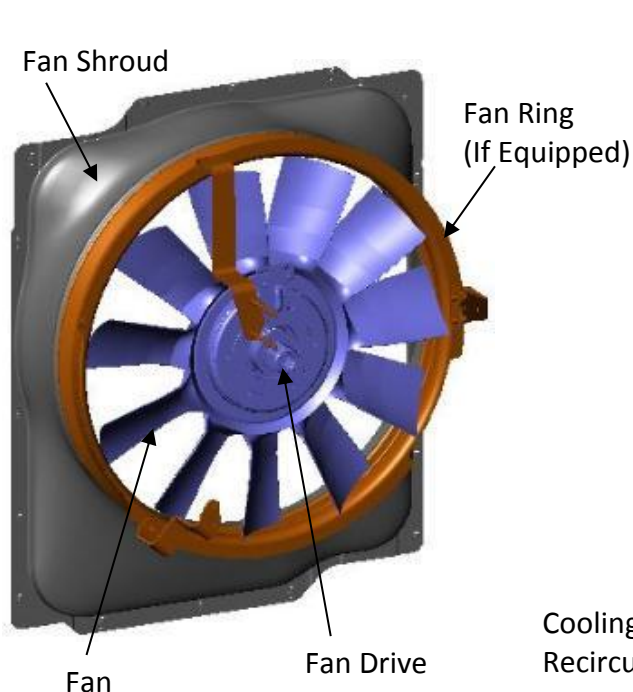


FIG. 7-7

Typical Fan, Drive, Ring, and Shroud

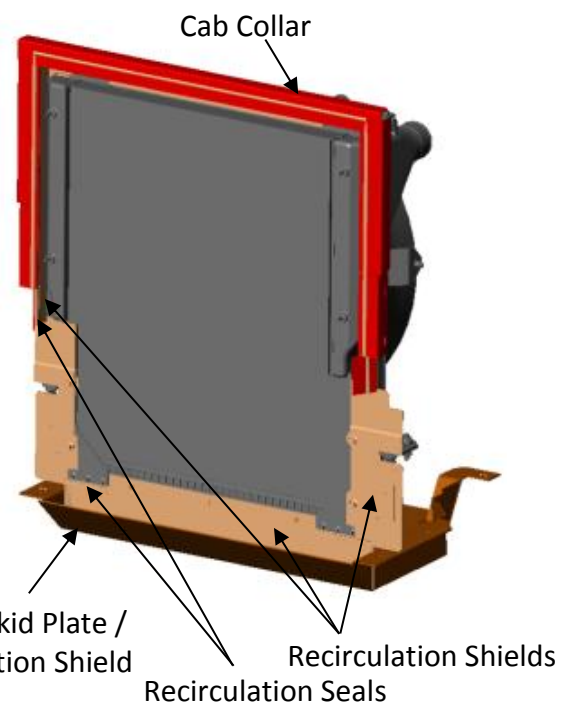


FIG. 7-8

Typical Airflow Recirculation Shielding

External Air Inlet

Airflow typically enters the radiator and charge air cooler through the grill and under the bumper. These locations are designed for air restriction minimization and temperature control for the radiator and charge air cooler to operate efficiently.

CAUTION

Unacceptable charge air or coolant temperatures may occur if changes are made to the external air inlet passages or obstructions are added near the grill or bumper (e.g. lights, speakers, hose reels, name plates, air conditioning condensers, etc...) and/or contaminants are allowed to collect. Charge air and coolant temperatures beyond the maximum operating temperatures may result in loss of performance and engine/transmission damage.

The air inlet passages **must** be inspected regularly to remove obstructions or contaminants that restrict air movement into the charge air and radiator coolers.

Recirculation Shields/Seals

Recirculation shields, seals and adjoining components form a positive barrier between the hot engine compartment air and the ambient inlet air to the charge air and radiator coolers. As air passes through the charge air and radiator coolers, heat is transferred from the coolers to the air. The recirculation barrier limits the amount of hot engine compartment air mixing with the ambient inlet air, allowing the coolers to operate at optimal performance. Recirculation shields may consist of add on shields, plates and seals to block engine compartment airflow, as well as components that act as sealing surfaces. The cab collar acts as a positive seal to the cooling system when the cab is locked down. All recirculation shields, seals and sealing components **must** be regularly inspected and maintained to control air inlet temperature by restricting the intrusion of hot under cab air back into the coolers. Seals **must** be inspected for wear and required positive contact with recirculation shields or other components. Failure to replace missing, damaged or leaking recirculation shields and seals may result in loss of performance, and/or engine/ transmission damage.

CAUTION

Increased charge air or coolant temperatures may occur if changes are made to the recirculation barrier components. Charge air and coolant temperatures beyond the maximum operating temperatures may result in loss of performance and engine/transmission damage.

Fan

The cooling system fan is located between the charge air and radiator coolers pulling external ambient air through the radiator and charge air coolers into the engine compartment. The movement of air through the coolers is necessary for optimal performance of the coolers during engine operation. The fan **must** be routinely inspected to ensure proper clearance to the shroud and that no fan damage is present. Damaged fans **must** never be repaired. Failure to replace a damaged fan may cause serious damage during engine operation.



Before inspecting fan, drive the engine must be turned "OFF".

Fan Drive

The fan drive is attached to the engine and rotates the fan via the engine accessory drive belt or engine geartrain. The fan drive may be in either a direct drive or clutched configuration. In the direct drive configuration, the fan is always rotating at a speed relative to engine speed. In the clutched configuration, the engine sends a signal for fan activation. Clutched configurations may be single (on/off) or variable speed types, and may be actuated via air, viscous, etc. Coolant temperature, engine temperature, etc... are factors in clutched fan drive operation. The fan drive **must** be routinely inspected to ensure that mounting hardware is

tight, the pulley/belt is aligned properly and no drive wear is present. For clutched fan drives, proper activation and controls **must** be inspected and tested. Failure to replace a damaged fan drive may cause serious damage during engine operation.

Fan Shroud

Promotes efficient movement of air through the charge air and radiator coolers to the fan. The configuration of the fan, shroud, and cooler is important to the overall performance of the cooling system. Routine inspection of the fan shroud is necessary to ensure proper fan clearance and ensure shroud to cooler sealing. Failure to maintain proper fan to fan shroud clearance may cause serious damage during engine operation.

Fan Ring (If equipped)

Promotes further efficiency of air movement through the charge air and radiator coolers to the fan. The addition of the ring to the fan, shroud, and cooler configuration is important to the overall performance of the cooling system. Routine inspection of the fan ring is necessary to ensure proper fan clearance and ensure shroud to ring sealing. Failure to maintain proper fan to ring clearance may cause serious damage during engine operation. Ring seals **must** be inspected for wear and required positive contact with shrouds and rings. Failure to replace missing, damaged, or leaking ring seals may result in loss of performance, and/or engine damage.

Transmission Cooling System

A properly designed and maintained transmission cooling system is critical to the durability and performance of the transmission. Transmission fluid temperature is elevated during transmission operation. The transmission cooling system removes this heat from the transmission fluid and transfers it to the coolant to ensure reliable transmission operation. FIG. 7-9 illustrates a typical transmission sump cooling system. FIG. 7-10 illustrates a typical transmission sump and retarder combined cooling system.

The transmission manufacturer's Owners Manual, and other service related documentation should be referred to for requirements pertaining to maintenance, or service procedures for the transmission and/or related systems. In addition to transmission manufacturer's documentation, the following information is provided for Spartan transmission cooling system operation and maintenance

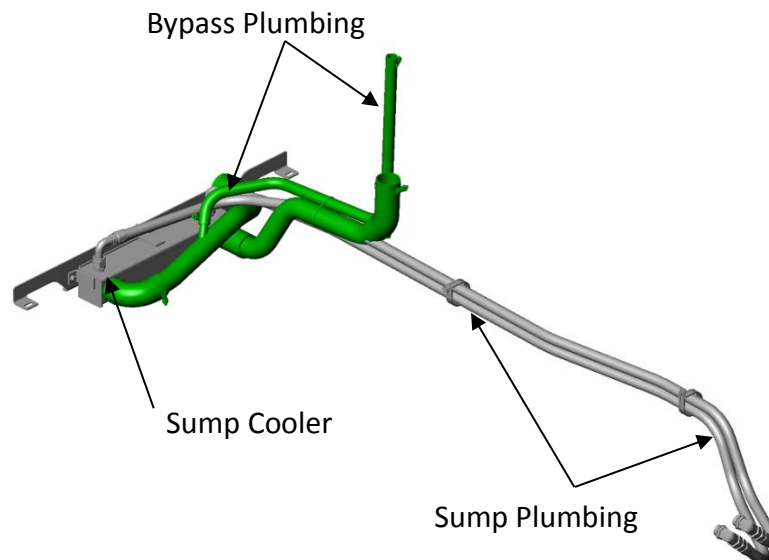


FIG. 7-9
Typical Transmission Sump Cooling System

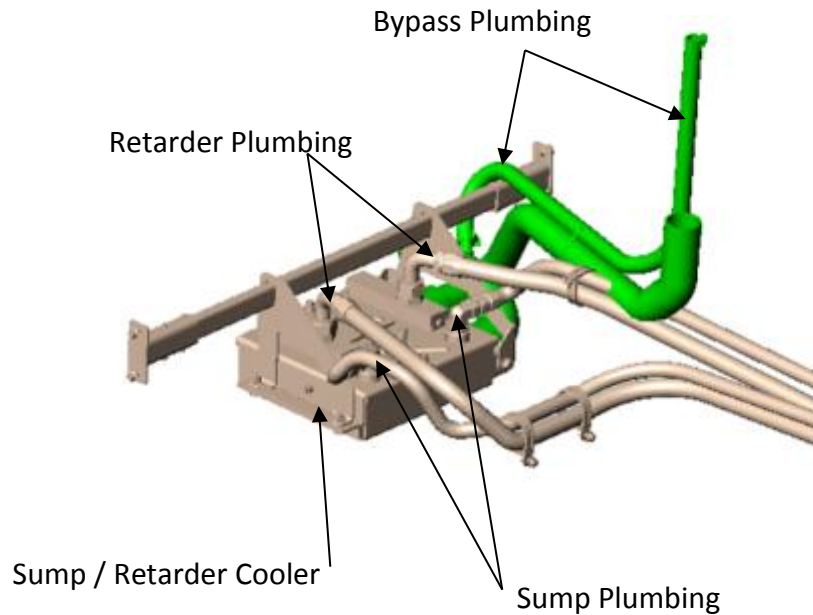


FIG. 7-10
Typical Transmission Sump and Retarder Combined Cooling System

Transmission Fluid Type

Transmission fluid is the medium that lubricates the internal transmission components and transfers the heat from the transmission's components to the transmission cooler for dissipation of heat. Proper transmission fluid is critical to the performance and durability of the transmission. Refer to the transmission manufacturer's documentation for proper selection, cautions, and warnings. Refer to the data label above the sun visor for fluid type and quantity as provided by Spartan.

CAUTION

The use of non-approved transmission fluid types for the transmission may result in transmission damage and void warranty.

Transmission Fluid Maintenance

Regularly maintained transmission fluid and filters are critical to the performance and durability of the transmission. Refer to the transmission manufacturer's documentation for intervals required to check/maintain the transmission fluid level, intervals to change transmission fluid and filters, and procedures for safely servicing the transmission.

Transmission Fluid Dipstick

The transmission fluid dipstick is used to manually check oil level to transmission requirements. The dipstick handle can be located in various locations based on application, ranging from access under the cab to remote access through a hatch.

Transmission Fluid Electronic Level Sensing

In applications where transmission fluid dipsticks cannot be accessed without tilting the cab, the transmission control pad can also be used to electronically monitor and check the transmission fluid level. This oil level sensing may not correlate exactly with the add mark on the dipstick, but is approved by the transmission manufacturer for use. Refer to the transmission manufacturer's documentation for electronic oil level checking and warnings.

Transmission Fluid Fill Port

The transmission fluid fill port is used to add transmission fluid as needed to bring the level on the transmission dipstick and/or control pad to proper operating range. The transmission fluid can be filled by removing the transmission dipstick and can be located in various locations based on application, ranging from access under the cab to remote access through a hatch.

Transmission Cooler

The transmission cooler is a critical component to proper operation of the transmission, and is sized appropriate to the transmission configuration. The transmission sends hot fluid into the transmission cooler. As the hot fluid passes through the transmission cooler the engine coolant in contact with internal cooler components transfers heat from the transmission fluid to the coolant. For this reason, the transmission cooler is considered an oil-to-coolant cooler. The transmission fluid is then returned back to the transmission to lubricate the transmission, remove more generated heat, and repeat the cycle. Typical mounting location for the transmission cooler is in the radiator coolant outlet plumbing between the radiator and the engine. Retarder and non-retarder transmission coolers differ in size and configuration as additional plumbing and heat rejection are required for the retarder application.

CAUTION

Transmission fluid temperatures may elevate above normal operating temperatures if obstructions are added near the radiator, contaminants are allowed to collect on the radiator, or damaged cooling fins exist. Transmission fluid temperatures beyond the maximum operating temperatures may result in loss of performance and transmission damage.

Regular inspection of the transmission fluid cooler is necessary to detect defects that degrade the performance of the transmission cooler. Inspect the cooler to ensure it is securely mounted and no external wear is occurring on the cooler.

CAUTION

Contamination of the transmission cooler during service or replacement may result in loss of performance and transmission damage.

Transmission Bypass Plumbing

The transmission bypass line is required for coolant flow through the transmission cooler when the engine is not warm enough for normal coolant flow. When the engine is cool, the thermostat is closed, and coolant is not allowed to flow through the radiator. The bypass line allows coolant to bypass the thermostat directly to the transmission cooler coolant inlet plumbing. This allows the coolant flow to remove heat from the transmission fluid until the engine thermostat opens and normal coolant flow occurs. Regular inspection and maintenance of the bypass line is necessary for overall performance of the transmission. Clamps and fittings **must** be routinely inspected to ensure joints between components are tight to prohibit leaks. Hoses **must** be routinely inspected for cracks, wear points, loose connections, or punctures that can cause leaks. Failure to replace a damaged or leaking bypass line may result in loss of coolant and may result in loss of performance, and engine and/or transmission damage.

Transmission Plumbing

The transmission lines allow for transmission fluid to travel between the transmission and transmission cooler during normal operation. Regular inspection and maintenance of the transmission lines is necessary for overall performance of the transmission. Clamps and fittings **must** be routinely inspected to ensure joints between components are tight to prohibit leaks. Hoses **must** be routinely inspected for wear points or loose connections that can cause leaks. Failure to replace any damaged or leaking transmission lines may result in loss of transmission fluid and may result in loss of performance and transmission damage.

A/C Condenser mounted to cooling package (If equipped)

The A/C condenser is an HVAC component that is sized and configured to cool the refrigerant in the A/C system. The A/C compressor will pressurize the refrigerant, which makes it hot. The hot, compressed gas passes through the condenser, gets cooled and becomes a liquid. The super-cooled liquid passes through the evaporator, which cools the passing cabin air, providing cool air. As the hot refrigerant passes through the condenser, the engine fan draws ambient air through the condenser grid, transferring the heat from the refrigerant to the air. There are several mounting locations for the A/C condenser. One location, if equipped, is at the front of the cooling package to the Charge Air Cooler. Refer to FIG. 7-11 below.

Regular inspection of the A/C condenser is necessary to maintain overall performance of the A/C system. If equipped, the A/C condenser should be maintained so the cooling grid remains clean and free of contaminants. The area between the condenser and CAC/Radiator **must** be inspected, cleaned and remain free of debris. Otherwise, A/C performance may be degraded and the air flow to the charge air cooler and radiator may be restricted resulting in engine overheating. Clean, low pressure water flushed through the cooling fins, and a soft brush to remove debris is recommended for cleaning.

CAUTION

The use of high pressure air, high pressure water and/or caustic cleaning solutions may damage the A/C condenser causing premature failure.

CAUTION

Contamination of the A/C condenser during service or replacement may result in loss of performance and HVAC damage.

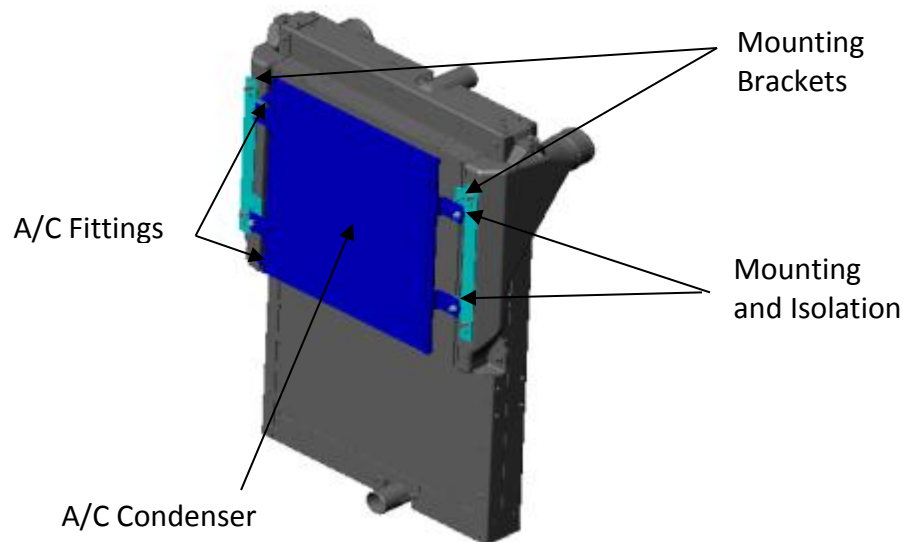


FIG. 7-11
A/C Condenser Location (if equipped)

Mounting and Isolation

The A/C condenser in cooling package (if equipped) is mounted to the charge air cooler and isolated from shock and vibration. Regular inspection and maintenance of the mounting and isolation components is necessary for overall durability of the A/C system. Fasteners and brackets **must** be routinely inspected to ensure the A/C condenser system is properly secured. Isolation components **must** be routinely inspected for cracks, wear points and loose connections that allow for excessive movement or interference during operation. Failure to replace any damaged mounting or isolation may result in failure of critical A/C condenser components.

EXHAUST/AFTERTREATMENT SYSTEM

CAUTION

Modifications to the exhaust and/or aftertreatment system are strictly prohibited without approval from Spartan Engineering and the engine manufacturer. Modifications may result in loss of performance, emissions compliance violations, and/or void warranty.

The exhaust/aftertreatment system moves exhaust gases from the engine to a suitable location on the vehicle while simultaneously cleaning the gases to environmental standards. Exhaust/aftertreatment systems include exhaust routing, aftertreatment, and tailpipe/temperature mitigation. FIG. 7-12 illustrates a typical exhaust/aftertreatment system.

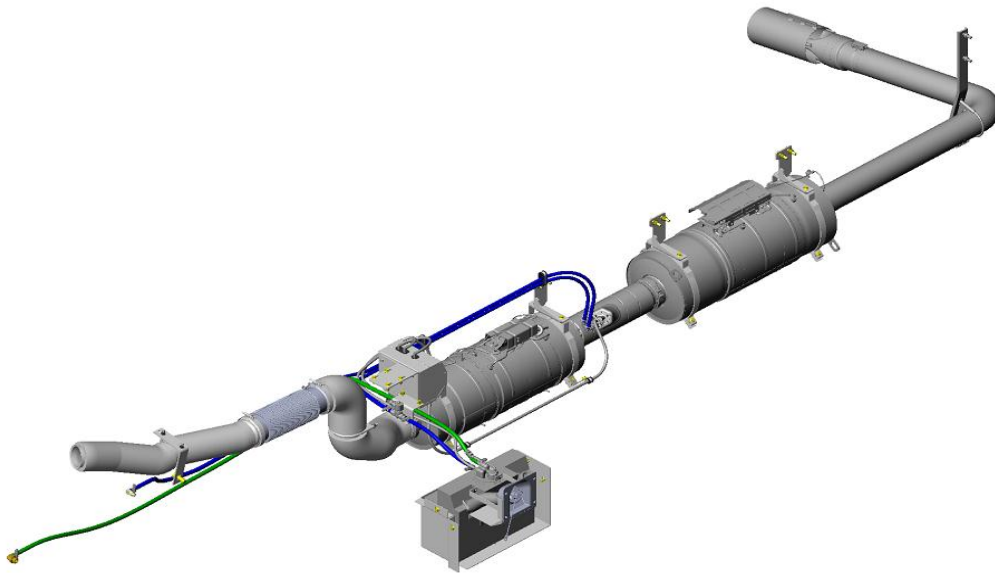


FIG. 7-12
Typical Exhaust / DPF-SCR Aftertreatment

Exhaust Routing

A properly designed and maintained exhaust routing system transfers exhaust gases from the engine to the aftertreatment system with minimum restriction to flow. FIG. 7-13 illustrates a typical exhaust routing system.

The engine manufacturer's Owner's Manual, service, and/or operations, and maintenance documentation **must** be referred to for all exhaust routing operations, maintenance requirements, and service procedures to be performed. Installation is certified with the engine manufacturer to follow all performance requirements and government regulations. In addition to the engine manufacturer's documentation, the following information is provided for Spartan cab and chassis exhaust routing operation and maintenance.

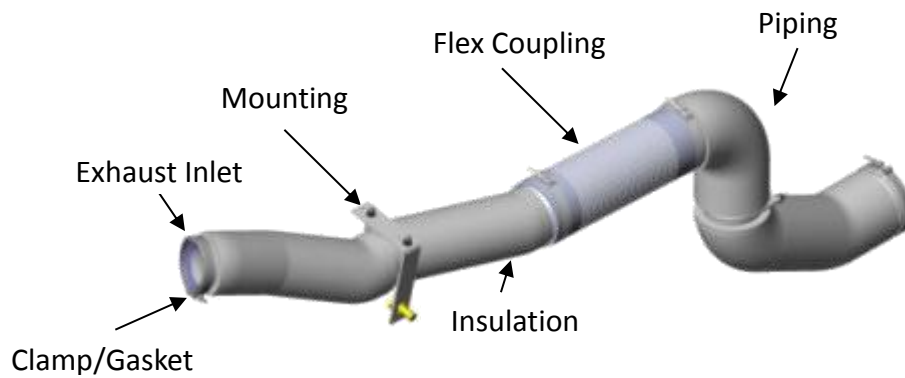


FIG. 7-13
Typical Exhaust Routing

Piping

Piping routes the exhaust gases from the engine to the downstream exhaust/aftertreatment components. Piping is typically wrapped with insulation to control the internal exhaust temperature necessary for proper aftertreatment and also to reduce heat effects on surrounding vehicle components and systems. Regular inspection and maintenance of the piping and insulation is necessary for overall performance of the exhaust and aftertreatment system. Pipes and insulation **must** be routinely inspected for cracks, wear points, loose connections, or punctures that can cause leaks. Failure to replace damaged piping and insulation may result in loss of engine and aftertreatment performance.

Flex Coupling

The flex coupling is mounted between engine mounted and vehicle frame mounted piping to isolate engine vibration and movement from downstream exhaust components. Regular inspection and maintenance of the flex coupling is necessary for overall performance of the exhaust and aftertreatment components. The flex coupling **must** be routinely inspected for cracks, wear points, loose connections, or punctures that can cause leaks. Failure to replace a damaged flex coupling may result in loss of engine and aftertreatment performance and cause damage to downstream components.

Mounting

V-band style clamps and gaskets are used to connect all routing components per engine manufacturer's standards. Piping is supported off the engine, transmission, and vehicle frame using brackets and u-clamps. All clamp torques should be checked regularly to verify proper sealing, support, and to check for damage. Regular inspection and maintenance of the clamps, gaskets and brackets is necessary for overall performance of the exhaust and aftertreatment system. Clamps **must** be routinely inspected to ensure joints between components are tight to prohibit leaks and contamination. Brackets **must** be routinely inspected for loose connections that can cause damage. Failure to replace a damaged mounting component may result in loss of engine and aftertreatment performance and cause exhaust damage.

Aftertreatment

A properly designed and maintained aftertreatment system filters and treats the exhaust gases to meet environmental standards before entering the atmosphere. Aftertreatment systems are dependent on the strategy required by the engine and include a DPF-SCR or DPF only. FIG. 7-14 illustrates a typical DPF-SCR exhaust aftertreatment system. FIG. 7-15 illustrates a typical DPF only exhaust aftertreatment system.

The engine manufacturer's owner's manual, service, and/or operations, and maintenance documentation **must** be referred to for all aftertreatment system operations, maintenance requirements, and service procedures to be performed. Installation is certified with the engine manufacturer to follow all performance requirements and government regulations. In addition to the engine manufacturer's documentation, the following information is provided for Spartan cab and chassis aftertreatment operation and maintenance.

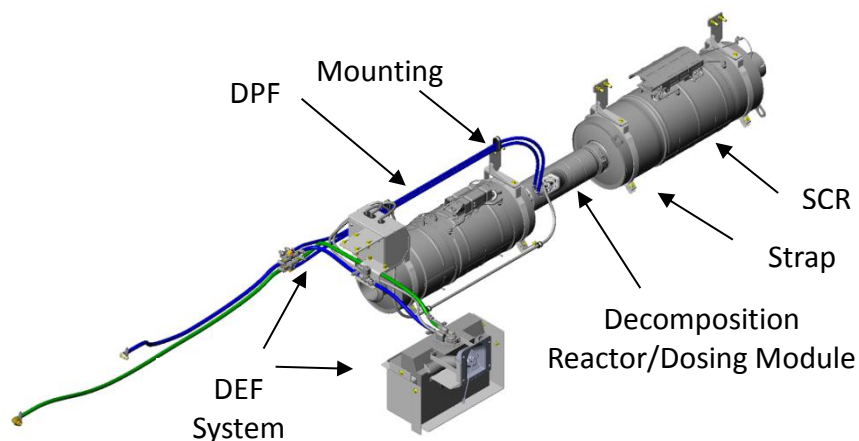


FIG. 7-14
Typical DPF-SCR Exhaust Aftertreatment System

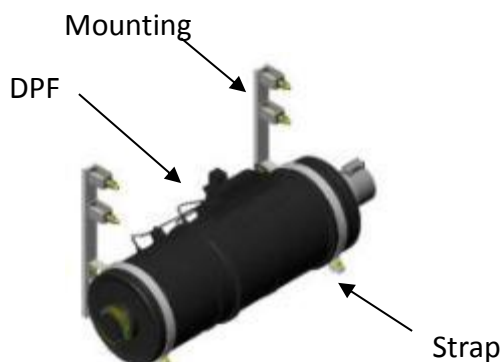


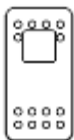
FIG. 7-15
Typical DPF Only Exhaust Aftertreatment System

Diesel Particulate Filter (DPF)

The DPF is designed to remove particulate matter from the exhaust gases of a diesel engine. It is mounted directly downstream of the exhaust routing system. For filter regeneration and cleaning refer to engine manufacturer's recommendation.



When performing stationery regeneration make sure vehicle is safely off roadway and exhaust is away from people and any other flammable materials, vapors, or structures. During regeneration, exhaust gas temperature could reach 800°C (1500°F) and exhaust system surface temperature could exceed 700°C (1300°F).



D.P.F. Regen Inhibit Switch – Used to inhibit active regeneration of the particulate filter will reset when ignition is cycled.

Decomposition Reactor/Dosing Module (If Equipped)

The decomposition reactor is mounted between the DPF and SCR. Mounted to the outside of the tube is the dosing module which injects the DEF into the exhaust stream to allow mixing before entering the SCR.

Selective Catalytic Reduction (SCR) (If Equipped)

The SCR is mounted downstream of the decomposition reactor. It contains a catalyst which uses the ammonia contained in the DEF to react with the exhaust gas NOx to form nitrogen and water.

Diesel Exhaust Fluid (DEF) System (If Equipped)

The DEF system is a network of lines, fittings, valves and controllers that control and inject DEF into the exhaust stream to work with the SCR and complete the aftertreatment process. FIG. 7-16 shows a typical DEF system.

CAUTION

Modifications to the DEF circuit and/or use of DEF that does not meet ISO 22241-1 are strictly prohibited without approval from Spartan Engineering and the engine manufacturer. Modifications may result in loss of performance, emissions compliance violations, and/or void warranty.

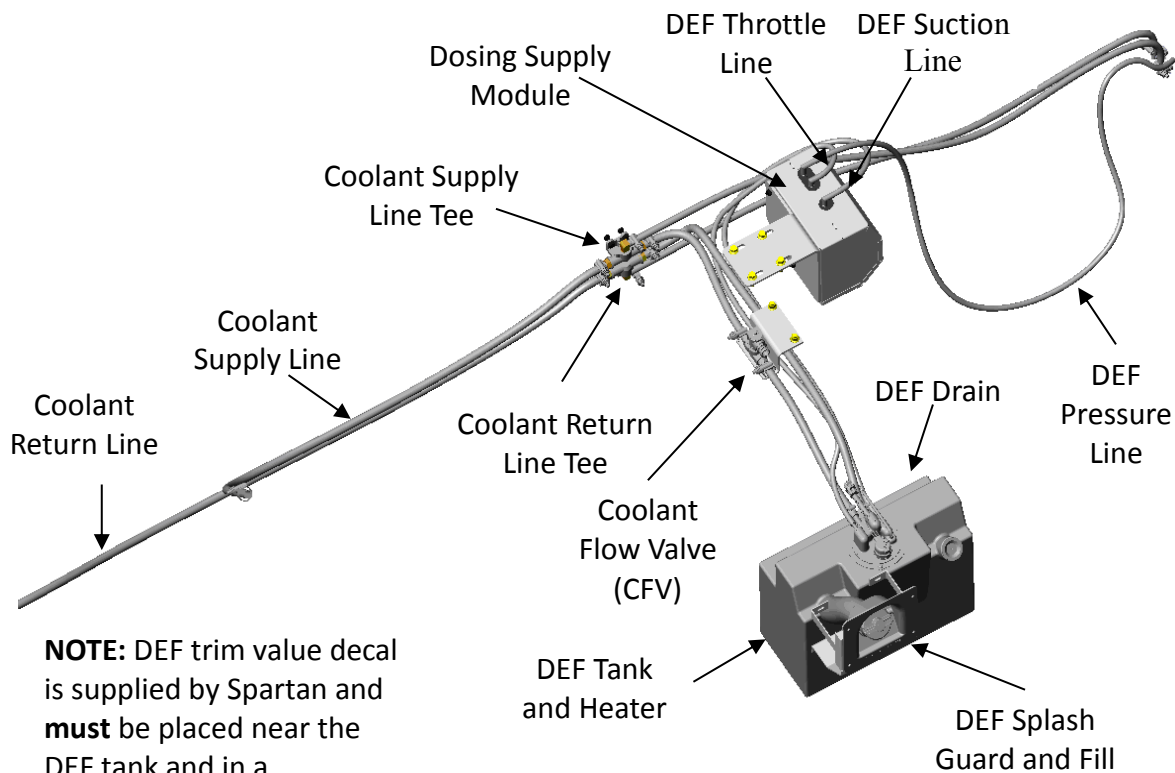


FIG. 7-16
Typical Diesel Exhaust Fluid System

Diesel Exhaust Fluid (DEF) Type (If Equipped)

DEF is a mixture of urea and water used in SCR aftertreatment systems. DEF can degrade due to environmental conditions and should be inspected frequently to determine quality. The engine manufacturer's Owner's Manual **should** be referred to for DEF requirements and information. DEF is mostly water and depending on vehicle operating conditions, an integrated tank heater may be required to allow thawing.

DEF Tank/Heater (If Equipped)

The DEF tank retains the diesel exhaust fluid and **must** be maintained according to engine manufacturer standards. Tanks are typically mounted inside the driver side battery box. The DEF tank **must** allow for freeze/thaw cycling as fluid temperature is only regulated during engine operation.

CAUTION

DO NOT overfill DEF tank. Proper fill level necessary to allow fluid expansion due to operating conditions and environmental factors.

Supply Module (If Equipped)

The supply module is mounted to the vehicle frame and contains an electronically operated pump that delivers a controlled amount DEF to the dosing module.

Coolant Lines/Fittings (If Equipped)

DEF coolant lines and fittings circulate engine coolant throughout the DEF system. During engine operation, coolant is constantly supplied to the dosing module to maintain temperature per engine manufacturer specifications. During extreme weather conditions, coolant is regulated to the DEF tank heater to prevent freezing using a flow valve.

DEF Throttle, Suction, and Pressure Lines (If Equipped)

The throttle and suction lines regulate the flow of DEF from the tank to the supply module. The pressure line is directly connected to the dosing module and transfers the required amount of fluid into the exhaust stream. All lines are electrically heated to prevent freezing in low temperature conditions.

Remote DEF Fill (If Equipped)

Vehicle configurations may require a remote fill location for the DEF tank due to cab style/length and body design. The remote fill will utilize the secondary rear fill location on the DEF tank which is shown in FIG. 7-17. The apparatus body builder will need to secure the splash guard to the body.

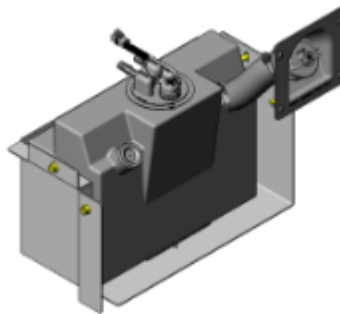


FIG. 7-17

Remote Fill for Diesel Exhaust Fluid System

DEF System Maintenance (If Equipped)

The DEF tank volume is rated for the vehicle fuel tank size and the fluid level **must** be checked when refueling the vehicle. Regular inspection and maintenance of the DEF system is necessary for overall performance and emission compliance of the exhaust and aftertreatment system. Hose fittings and clamps **must** be routinely inspected to ensure connections between components are tight to prohibit leaks and contamination. Brackets **must** be routinely inspected for loose connections that can cause damage. Failure to replace a damaged mounting component may result in loss of engine and aftertreatment performance.

Mounting

Brackets and straps are used to secure the DPF and SCR to the vehicle frame. Straps are attached to specific areas on the DPF and SCR determined by engine manufacturer. V-band style clamps and gaskets are used to connect DPF, SCR, and decomp tube. All clamp torque should be checked regularly to verify proper sealing,

support, and check for damage. Regular inspection and maintenance of the clamps, gaskets and brackets is necessary for overall performance of the exhaust and aftertreatment system. Clamps **must** be routinely inspected to ensure joints between components are tight to prohibit leaks and contamination. Brackets **must** be routinely inspected for loose connections that can cause damage. Failure to replace a damaged mounting component may result in loss of engine and aftertreatment performance and cause exhaust damage.

Tailpipe/Temperature Mitigation

A properly designed and maintained tailpipe/temperature mitigation system removes exhaust gases from the system following the aftertreatment process. FIG. 7-18 illustrates a typical tailpipe/temperature mitigation assembly.

The engine manufacturer's Owner's Manual, service, and/or operations, and maintenance documentation **must** be referred to for all tailpipe/temperature mitigation operations, maintenance requirements, and service procedures to be performed. Installation is certified with the engine manufacturer to follow all performance requirements and government regulations. In addition to the engine manufacturer's documentation, the following information is provided for Spartan cab and chassis tailpipe/temperature mitigation operation and maintenance.

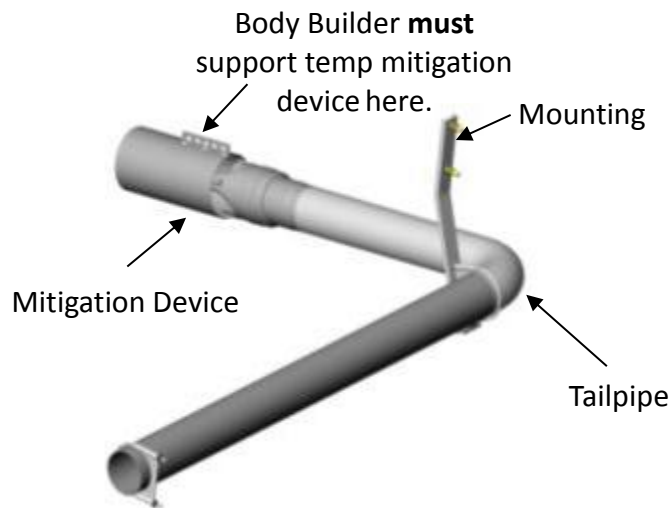


FIG. 7-18
Typical Exhaust Tailpipe/Temperature Mitigation

Tailpipe

The tailpipe is mounted downstream of the aftertreatment system and is connected to the DPF or SCR (if equipped) and is usually positioned just forward of the rear tires. Regular inspection and maintenance of the piping is necessary for overall performance of the exhaust and aftertreatment system. Pipes **must** be routinely inspected for cracks, wear points, loose connections, or punctures that can cause leaks. Failure to replace damaged piping may result in loss of engine and aftertreatment performance.

Temperature Mitigation

The temperature mitigation device reduces exhaust gas temperature at the exit by mixing exhaust gas with ambient air. The temperature mitigation device is sized for the engine and exhaust pipe used. This part is supplied with the chassis and needs to be mounted at the end of the tailpipe and secured to the body by manufacturer.



Modifying the temperature mitigation device or blocking ambient air flow to the device could limit performance, resulting in elevated temperatures at the exit, which may exceed NFPA guidelines.

Mounting

Brackets secure the tailpipe to the vehicle frame. The tailpipe and mitigation device are assembled using u-clamps or lapping clamps. The mitigation device **must** be secured at location shown in FIG. 7-18 by body builder. All clamp torque should be checked regularly to verify proper sealing and check for damage. Regular inspection and maintenance of the clamps and brackets is necessary for overall performance of the exhaust and aftertreatment system. Clamps **must** be routinely inspected to ensure joints between components are tight to prohibit leaks and contamination. Brackets **must** be routinely inspected for loose connections that can cause damage. Failure to replace a damaged mounting component may result in loss of engine and aftertreatment performance and cause exhaust damage.

8.0

TRANSMISSION



TRANSMISSION

All operators and owners should read the transmission operation manual before operating the vehicle. For complete transmission information, refer to the applicable manual.

SHIFT SELECTOR

The transmission shift selector is either pushbutton or t-handle (lever). A full description and function for each type of selector is included in the transmission operation manual supplied with your vehicle.

OIL CHECK PROCEDURE

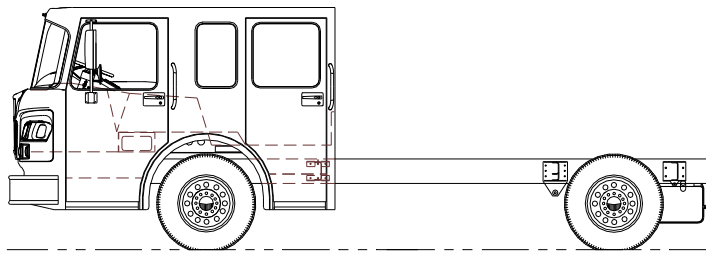
Fluid level is critical to the transmission operation. Refer to the applicable manual to determine the appropriate method of obtaining the oil level reading.

Weekly, check transmission oil for contamination of water/glycol via the dipstick. The engine should be running for this inspection.

DIAGNOSTIC INCIDENT DISPLAY PROCEDURE

To check for diagnostic codes, be sure the vehicle is safely stopped, the park brake is activated, and the transmission is in neutral. Refer to the applicable manual for detailed explanation of accessing, viewing, and clearing code information.

MAINTENANCE FOR TELMA[®] RETARDERS (IF EQUIPPED)



MAINTENANCE FOR TELMA® RETARDERS (IF EQUIPPED)

GOAL	FREQUENCY	METHOD	
Washing	Twice a year	Pressurized water, air dry	
Greasing TELMA® (Driveline mount)	Every 40,000 miles	Fill grease fitting until grease appears at air hole. Avoid grease leakage.	
Mechanical Maintenance	Check at 3,000 miles	Check every 12,500 miles	Check every 40,000 miles
No abnormal play rotor/stator	X	X	X
Tighten bolts & screws	X	X	X
Driveline seals		X	X
Air Gap Measurement	X	X	X
Axle Pinion Seal		X	X
Condition of shock mount (Rubber)			X
Verify the TELMA® Disengages when Vehicle stops	X	X	X
Electrical Maintenance	Check at 3,000 miles	Check every 12,500 miles	Check every 40,000 miles
Verify Amperage of Retarder			X
Wiring insulation			X
Coil connections			X
Tighten connectors	X	X	X
Ground terminal condition/tightness	X	X	X
Contact box function/condition/tightness	X	X	X
Foot control	X	X	X
Cutoff switch	X	X	X
Indicator lights	X	X	X

9.0 AXLES/WHEELS & TIRES



WEIGHT INFORMATION

It is important that drivers and maintenance personnel understand weight rating terminology as described below. For safety and proper chassis function, it is critical that:

- The axle and tire/wheel weight ratings are not exceeded.
- Proper tire pressures are maintained.
- The major chassis components supporting the vehicle **shall** not to be changed or replaced by components with lower ratings without considering the entire weight of the vehicle (i.e. tires).

TIRES AND WHEELS

Many tire weight ratings for fire service are based on intermittent use. Intermittent use is defined as: no more than 50 miles of continuous operation under full payload without stopping for a 20 minute cool down.

If it is necessary to travel more than 50 consecutive miles without meeting the cool down requirement, speed **must** be reduced to 50 mph for the balance of the trip.

It is critical that the proper tire pressure is equivalent side-to-side on the same axle. The maximum tire pressure is stated on the vehicle certification label.

Replacement wheels and tires **must** have equivalent load carrying capacity as the original equipment. Wheels **must** have the same rim width, rim offset, and mounting configuration as the original equipment, while tires **must** be of the same size and type, and conform to government regulations. Wheel nut torque is 450-500 lbs. ft.

Note: Tire balancing on independent front suspensions requires the use of adhesive weights for clearance.

Re-torqueing should occur after the initial 50-150 miles are covered in normal driving conditions. This practice ensures that the opportunity for over tightening is minimized. There is little benefit from re-tightening wheel nuts prior to reaching this service threshold, since joint relaxation may be only partial. If audits of initial installation torque are desired, they should be performed as shortly after the initial tightening as possible and should determine the breakaway torque values (the amount of torque required to just begin movement of the nut in the tightening direction).

Check the condition of the tires daily. Look for any bumps, blisters, cuts, punctures, cracks, uneven wear, check for proper inflation, and tread depth. Replace tire on front axle when tread is worn to 4/32 in. (3.175 mm). Replace tire on rear axle when tread is worn to 2/32 in. (1.5888 mm). Always check inflation pressure when tires are cold.



Always maintain tires in good condition. Frequently check and maintain correct inflation pressures as specified by the tire manufacturers. Inspect periodically for abnormal wear patterns and replace/repair cut or broken tire casing. Always use experienced properly trained personnel with the correct equipment and procedures to mount or remove tires. Failure to adhere to these warnings could result in tire malfunction, damage to vehicle, personal injury, and possible death.

ROLLING RESISTANCE

For model year 2014 and later vehicles, rolling resistance of the tires is critical to greenhouse gas emissions and fuel economy of the vehicle. This vehicle was originally built with tires that are appropriately rated for the weight capacity they may be expected to carry. When replacing tires, it is critical to consider tires with similar tread patterns and the same load capacity as those of which the vehicle was originally equipped. Should you have questions regarding replacement tires, please contact Spartan or your nearest tire distributor.

TIRE PRESSURE

Tire pressures **must** be monitored closely to assure safe operation of the vehicle. Spartan recommends checking tire pressure daily when the vehicle is in service. It is important to understand that a change in weight distribution or the amount of weight added or removed from the vehicle may require a change to tire pressures. Refer to the Gross Axle Weight section of this manual and the tire manufacturer's manual for details.

TIRE PRESSURE INDICATORS

If tire pressure indicators were ordered through Spartan, the indicators may be obtained by redeeming a voucher through Spartan Customer & Product Support. To redeem the voucher, the customer will be required to supply Spartan with the Sales Order number or VIN, Vehicle Odometer Reading at time of request, and accurate in-service weights for each axle on the vehicle. This will allow Spartan to provide a set of tire pressure indicators that accurately corresponds to the pressure that the tires should be set at for that particular application.

TIRE CHAINS (IF EQUIPPED)

Your Spartan cab and chassis may be equipped with a tire chain system. At the push of either a rocker switch or a virtual switch on the V-MUX[®] Vista screen, the system provides the driver with chains under the tires to aide with traction in snowy/icy conditions. To engage tire chains the vehicle **must** be traveling between 2 MPH and 25 MPH. Tire Chain will automatically disengage if greater than 30 MPH. Vehicle **must** be reduced to a speed below 5 MPH for the tire chains to be engaged or re-engaged. For additional information on maintenance and operation of the system, please refer to the manufacture's literature.

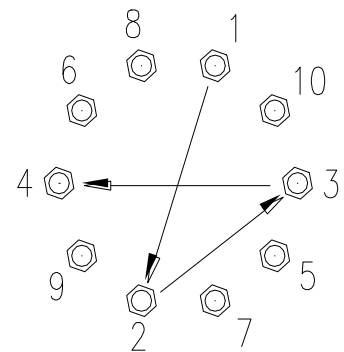


Due to high spring tension, Disassembly / Assembly of the air cylinder should be done only by qualified personnel.

INSTALLATION AND TIGHTENING OF TIRES AND WHEELS

Before installing wheels, clean all mounting surfaces with a wire brush. Check to make sure the threads are clean. Refer to the wheel manufacturer's installation and maintenance manual included with this manual for the proper inspection and installation procedures.

- ◆ The use of manual torque wrenches **must** be carefully monitored. Dial type torque wrenches are preferred. Click-style wrenches are typically not as accurate as dial-type and can also be affected by hand position. The click-style is also not well suited for determining accurate breakaway torque values. Regardless of type of wrench used, care **must** be exercised so that no more than 500 ft. lbs. are actually applied.
- ◆ Re-tightening of wheel nuts should be accomplished "cold" and not with excessively hot brakes. A good rule of thumb for checking this is to retighten only after the wheel disc and nuts are cool enough for continuous skin contact.



TANDEM AXLE OPERATION (IF EQUIPPED)

A driver control interaxle lock switch is located on the console panel. In slippery and off road conditions apply lock up at low torque application. This will provide evenly distributed drive to both leads and rear axles.

NOTE: This is independent of the side-to-side differential in each axle that has optional differential locks.

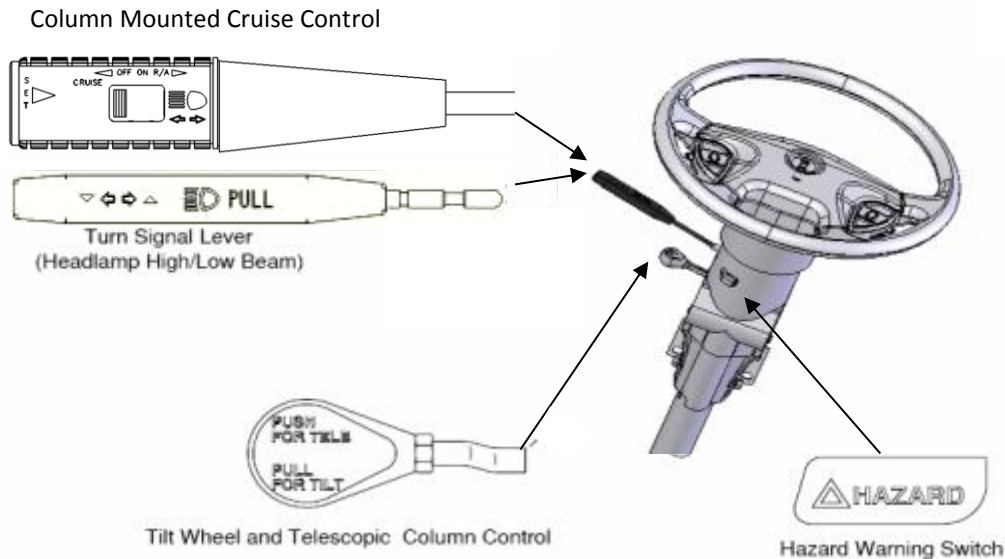
10.0 STEERING, BRAKES, AND SUSPENSION



STEERING SYSTEM AND COLUMN CONTROLS

TILT & TELESCOPING STEERING COLUMN

To provide optimum steering wheel position, the steering column is fully adjustable. Also featured on the column are the horn button, directional switch, high beam switch, and four-way flasher switch.



To Telescope Wheel

Push down on the lever located below the directional switch on the left side of the column while simultaneously raising or lowering the wheel to the desired position.

To Tilt Wheel

Pull up on the lever located below the directional switch on the left side of the column while simultaneously tilting the wheel to the desired position.

Horn Button

The horn button is in the hub of the steering wheel and activated by depressing the button.

Turn Signal Lever and High Beam Switch

This is located on the left side of the steering column below the wheel. It operates the turn signals and is self-canceling type. This lever also controls the headlight high beam function. To turn the high beams on or off, raise this lever until it clicks into position and release. An instrument panel indicator blue light will illuminate when you have selected high beam.

Hazard Four Way Flashers

This switch is located under the column towards the left side. Pull the slide switch out to turn on and push in to turn off.

Column Mounted Cruise Control (if equipped)

Cruise control is integrated into the turn signal lever on the steering column. Refer to the illustration above to identify their location.



DO NOT use the cruise control function during inclement weather, adverse road conditions, or in heavy traffic.

The cruise functions are **cancelled** when the brake pedal is applied.
Cruise control functions operate as follows:

<u>Press and Release:</u>	<u>To:</u>
'ON'	Activate the cruise system.
'OFF'	Deactivate the cruise system.
'SET/COAST'	Set: Sets cruise speed at the speed the vehicle is traveling when applied. Coast: Decreases the set cruise speed when control is pressed and held.
'RES/ACCEL'	Res: Resets to the previously set cruise speed if cruise has been cancelled and still 'on.' Accel: Increases set cruise speed when control is pressed and held.

Turn Signal Lever and High Beam Switch

This is located on the left side of the steering column below the wheel. It operates the turn signals and is self-canceling type. This lever also controls the headlight high beam function. To turn the high beams on or off, raise this lever until it clicks into position and release. An instrument panel indicator blue light will illuminate when you have selected high beam.

Hazard Four Way Flashers

This switch is located under the column towards the left side. Pull the slide switch out to turn on and push in to turn off.

STEERING WHEEL CONTROLS (IF EQUIPPED)

Refer to FIG. 10-1



Do not push buttons on the steering wheel while turning the ignition switch from the off to the on position. If button is pushed, recycle ignition without pressing buttons.

Fog Lights

When the fog lights are 'OFF' and this button is pressed, the fog lights will turn 'ON'. The opposite occurs if the button is pressed again.



Wiper Control Functions

The four buttons on the lower left side are the wiper control buttons.



Wiper Variable Display

If the button is pressed one time, and not pressed again within 30 seconds, the wipers will 'pulse' – completing only one cycle. If the button is pressed a second time within 30 seconds, an ongoing delay wipe function will occur. The delayed time interval between wipe cycles will equal the time interval between when the button was pressed the first and second time. Initiation of any other wiper function will override the variable setting.



Wiper Wash

Press to pump and squirt fluid onto the windshield. If pressed when the wipers are off, the wipers will complete approximately 3 cycles and then turn off again.



Wiper High / Low

Press to activate wipers. When initially turned on, the wipers will be at low speed. Pressing the button a second time shifts the wipers to high speed. Every time the button is pressed, the wipers alternate between low and high speed.



Air Horn

Press to activate air horn.



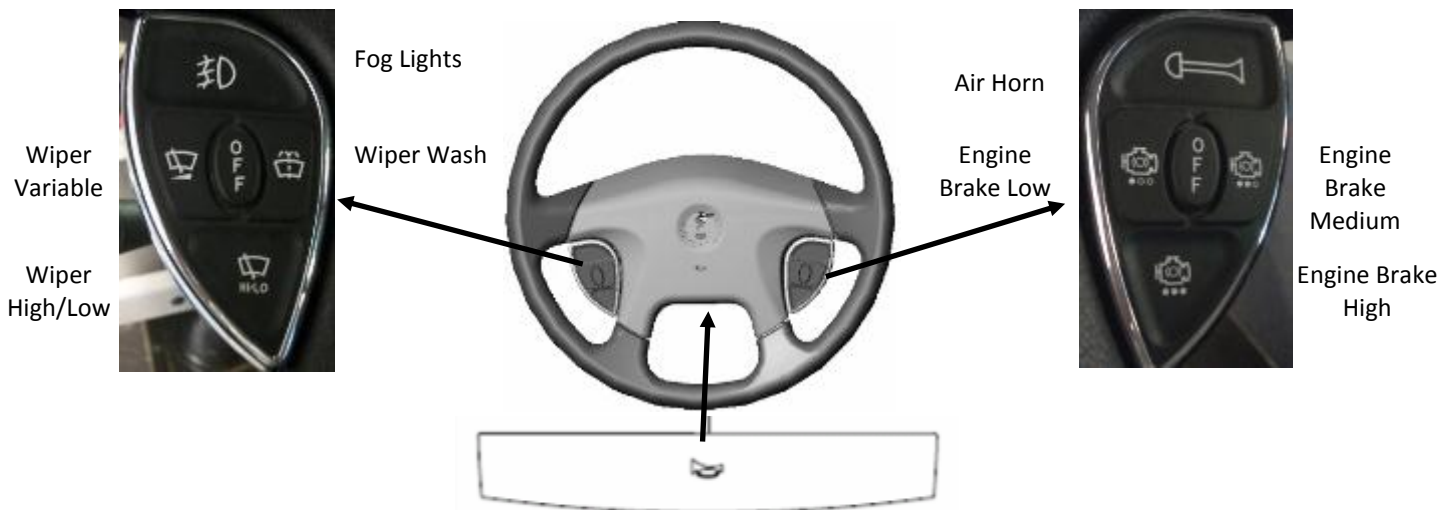
Auxiliary Engine Brake Control Functions

The four buttons on the lower right side are the auxiliary engine brake control buttons. They are as follows: Engine brake low, on/off switch, engine brake medium, and engine brake high.



FIG. 10-1

Steering Wheel with Center Controls



GENERAL INSPECTION AND MAINTENANCE

- Ask your service mechanic to examine the steering mechanism. Minor adjustments could head off problems.
- Check tie rod, drag link end clamp bolts, and ball joints. They **must** be kept tight.
- Check for installation and spread of cotter pins and tightness of nuts at both ends of tie rod and drag links.

- Check to see that the pitman arm (steering arm at steering gear) mountings are tight and locked.
- Check system for leaks or hose chafing and if necessary replace at once.
- Check for proper steering gear and power steering pump lubricant levels.
- Regularly inspect steering column joint bolts and steering linkage, particularly for body-to-chassis clearance.



Failure to maintain the steering system in proper condition can cause reduced steering ability resulting in personal injury and property damage. Have any steering problems corrected by a qualified mechanic.

Maintain Steering Column Joint Bolts

As a good maintenance practice, it is recommended that steering column joint bolts be checked for tightness a minimum of every 300 engine hours/6 months, whichever occurs first. Tighten bolts to the torque specified in the table. **DO NOT OVER-TIGHTEN.**

Maintain Hydraulic Power Steering System

Whenever the hydraulic (power steering) system has been opened for any reason, air **MUST** be removed from the system before placing the vehicle in service.

BRAKE OPERATION

The chassis has an air brake system. To prevent brake bounce, the driver should make brake application by placing heel of foot on the floor, while applying a smooth, even force on the treadle valve pedal (brake pedal) with the ball of foot.



Excessive use of the service brakes may cause them to heat up and reduce their stopping ability.

BRAKE INSPECTION

Regular inspection is required including the proper draining of any water from air tanks. This will indicate if the air dryer and check valves between tank systems are functioning properly. For further information, refer to Axle Manufacturer's Manual.



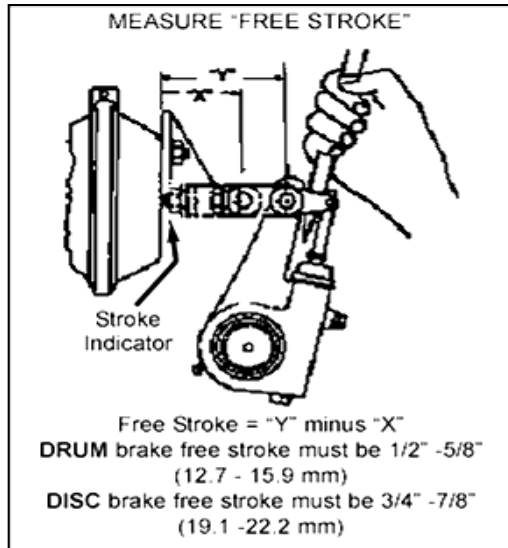
SLACK ADJUSTER INSPECTION

Inspect slack stroke to ensure automatic adjuster is working. Stroke indicator on chamber rod (Color or Knurled Band Exposed) indicates slack may need adjusting. Verify by referring to the "free stroke" below.

CHECK OPERATION OF THE AIR BRAKE SYSTEM

Weekly (or when air tanks are normally bled off for water content), the air brake system should be checked for proper function. This test assures the check valves are cycled in the system and ensures proper performance of dual air system. When performing pedal applications, depress and hold while listening for air leaks.

A visual inspection of the slack adjuster travel **must** also be made to ensure the slack adjusters are properly adjusted. Refer to the slack adjuster inspection section for further details.



U.S. DOT Stroke Limits 80-90 psi (550-620Kpa) Pressure in Air Chamber. Clamp Type Air Cleaner	
Chamber Type (Size)	Adjust the stroke as short as possible without the brakes dragging. The vehicle may be put out of service if the stroke is not:
9	less than 1-3/8" (34.9 mm)
12	less than 1-3/8" (34.9 mm)
16	less than 1-3/4" (44.4 mm)
20	less than 1-3/4" (44.4 mm)
24	less than 1-3/4" (44.4 mm)
30	less than 2" (50.8 mm)
36	less than 2-1/4" (57.1 mm)

**Refer to Manufacturer's Service Manual
for Proper Adjustment Procedure**

NOTE: Vehicle must be parked on level surface, wheel chocks or curbing installed at the front and rear tires, and park brake in the off position.

STEP #1

Start engine and build both air systems to full system capacity, approximately 120-130 psi. Shut the engine off.

NOTE: System #1 should build up to 90 psi before system #2 starts to change.

STEP #2

Drain the air from system #2. After the air is drained from system #2, apply the brake pedal. The rear brakes should function. The park brake valve **must** be in the off position to perform this test.

STEP #3

Start the engine and recharge both systems to full capacity; approximately 120-130 psi. Shut the engine off.

STEP #4

Drain air from system #1. After the air is drained from system #1, apply the brake pedal. The front and rear brakes should both work. The park brake valve **must** be in the off position to perform this test.

If the truck is not equipped with self-adjusting wedge brakes, "P" type "S" cam with automatic slack adjusters, or self-adjusting disc brakes, then visually inspect brake function by observing slack adjuster travel. Travel should not exceed dimension in chart on previous page (refer to the appropriate manufacturer's maintenance manual for proper adjustment).

NOTE: Park brake system is integral with rear brakes and they MUST be properly adjusted to ensure hold power.

IF THE BRAKES DO NOT FUNCTION AS DESCRIBED ABOVE, CONTACT SPARTAN IMMEDIATELY.

AUXILIARY BRAKING

VGT (VARIABLE GEOMETRY TURBOCHARGER), EXHAUST BRAKE, OR COMPRESSION BRAKE (IF EQUIPPED)

Description

The auxiliary brake is a vehicle-slowng device only, not a vehicle stopping device. It therefore is not a substitute for the service braking system. The service brakes **must** be used to bring the vehicle to a complete stop.

Operation

Activating the dash switch will create automatic braking when there is no throttle application. This is a diesel engine retarder and is power absorbing by exhaust restriction similar to an air compressor or a vacuum pump.

Some auxiliary brake designs have a switch for selection of high, low, and/or medium absorbing capacity. The brake operates with or without service brake application.

All brakes are most effective at governed engine speeds. Lower gear selection will give maximum retarding power. Transmission pre-select can be set for gear ranges 2-5 or 2-6 and will ensure maximum braking when brake is turned on. Pre-select keeps engine RPM speed at governor shift points for maximum braking and cooling.

In the case of an ABS event, or active faults, the auxiliary brake is automatically deactivated.



Vehicles equipped with an auxiliary braking device may lose control in wet or slippery road conditions if ABS system is in the failure mode and the braking device is activated. See auxiliary brake manufacturer's manual for safe operating practices.

TRANSMISSION OUTPUT RETARDER (IF EQUIPPED)

Description

The transmission output retarder absorbs horsepower on the driveshaft and slows the vehicle. When using the transmission output retarder, the energy is transferred to heat to be dispatched by the cooling system.

Standard Operation

A switch mounted on the dash turns on the retarder. Completely removing foot from the accelerator applies the first one third of the retarder.

Applying pressure to the brake pedal applies the remaining two-thirds of the retarder capacity.

The transmission temperature **must** be monitored. TURN OFF if it reaches the 300° level.

Transmission pre-select can be set for gear ranges 2-5 or 2-6 and will ensure maximum braking when brake is turned on. Pre-select keeps engine RPM speed at governor shift points for maximum braking and cooling to retarder and fan speed.



The retarder will not bring the vehicle to a stop. You must apply the chassis brake to bring the vehicle to a full stop.

ELECTRIC DRIVELINE RETARDER (IF EQUIPPED)

Description

The Electric Driveline Retarder is an auxiliary braking device located in the driveline. Its purpose is to supply additional braking torque to avoid fading of the chassis brakes that result from frequent stopping. This will allow the chassis brakes to be more effective during a braking event and improve brake life.

Operation

The Electric Driveline Retarder is activated by brake pedal application. The level of effectiveness is increased as the pedal is further depressed. The levels of progression are displayed by the four amber indicator lights on the instrument panel. When the retarder is activated, the brake lights illuminate.

The toggle switch (on/off) located on the switch panel near the headlight switch will enable or disable the Retarder operation. This switch is used to disable the retarder in the event of slippery road surfaces.



The retarder will not work when vehicle speed is below (3) three m.p.h. You must apply the chassis brake to bring the vehicle to a full stop.

PARK BRAKE

- Pull valve to apply the parking brake after vehicle is stopped.
- Push to release until valve stays in and park lamp goes out in warning lamp cluster.

NOTE: The valve will not release until the air system maintains a minimum of 35 psi.



IFS-24K SUSPENSION (IF EQUIPPED)

If unit is equipped with an IFS-24K axle refer to axle manufacturer's manual for detailed information.

KNEELING FEATURE (IF EQUIPPED)

Feature allows the vehicle to lower several inches by exhausting air from the air springs. A rocker switch or V-Mux® switch controls actuation. The park brake **must** be engaged; otherwise, the suspension will automatically air up.

MAINTENANCE SCHEDULES AND CHECKLIST

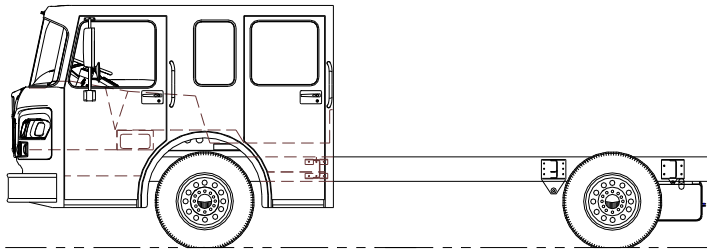
Maintenance **must** be performed to keep your vehicle in good operating condition. It is necessary to perform maintenance checks, inspections, lubrication, cleaning, or other types of service. Regular maintenance helps avoid potential problems and may help correct problems before they become serious.

The following maintenance schedule is arranged into mileage and time intervals. The intervals listed are the maximum and **must** not be exceeded. If your vehicle is operated on very hilly terrain, or in a very dusty or sandy environment, you may need to reduce the time between scheduled maintenance intervals. The maintenance schedule may be copied and used as a check off sheet.

Perform maintenance at whichever interval occurs first. When reaching a particular service level, inspect / perform all previous maintenance items that may be due.

APPENDIX A

MAINTENANCE CHECKLIST



MAINTENANCE SCHEDULE

RECOMMENDED MAINTENANCE PRACTICES

- Ensure daily and stated maintenance interval checklist items are performed.

If any information should seem unclear, please contact Spartan Customer & Product Support at 1-800-543-5008 Option #1.

Service to Perform	Intervals		
	Daily	Annually	Every 300 hours/6 months Whichever Occurs First
Check Engine Oil Level	X		
Check Transmission Fluid Level	X		
Check Engine Coolant Level	X		
Check Power Steering Fluid Level	X		
Check for Fluid Leaks Under Vehicle	X		
Check Tire Condition	X		X
Check Windshield Wiper Function and Wash	X		
Check Park Brake Actuation	X		
Test Air System	X		
Verify Operation of Gauges	X		X
Check Oil Pressure	X		X
Check Horn	X		X
Inspect Mirror Mountings and for Cracks	X		X
Inspect Windshields for Cracks or Chips	X		X
Check Seats for Excessive Wear			X
Check Seat Belt Actuation	X		X
Check Steering for Free Play			X
Check Air Compressor Governor			X
Check Air Dryer Operation			X
Check Climate Control System			X
Check Engine for Noise Such as Knocks or Misses			X
Check hubs and seals for leaks			X
Inspect Steering Box & Hoses for Leaks			X
Inspect Steering for Loose or Worn Parts	X		X
Inspect Steering Linkage Fasteners			X
Inspect Springs, Hangers, & U-bolts			X
Check Engine and Transmission Mounts			X
Check for Leaks: Oil, Fuel, Transmission Fluid, and Coolant			X
Inspect Drive Line: U-joints and Slip Shafts			X
Inspect PTO Drive Line			X
Inspect Brake Chambers: Leaks and Hoses			X
Inspect Brakes, Drums or Rotors			X
Inspect Differential: Leaks and Breather			X

Check Differential Oil Level			X
Check Pump Gear Box Fluid Level			X
Check Transfer Case Fluid Level			X
Inspect Exhaust System for Leaks and Component Secure			X
Check Tire Air Pressure			X
Torque Lugs			X
Check for Bent or Damaged Wheels			X
Check all Lights and Reflectors	X		X
Inspect Cab for Damage	X		X
Check All Cab Doors, Hinges and Latches	X		X
Inspect Cab Latches and Mounts	X		X
Inspect Fuel Tank Mounting, Leaks and Cap			X
Inspect Cross Members for Cracks			X
Check Drive Belts	X		X
Check all Hoses	X		X
Test Coolant System for Leaks			X
Inspect Air Conditioning Compressor Mounting			X
Inspect Alternator Mounting and Cables			X
Check Radiator, Heat Exchanger			X
Check Coolant Fan & Shroud for Clearance, Chips, etc.			X
Inspect Air Intake System and Air Filter			X
Inspect Battery Cables (Tight and Corrosion)			X
Verify Starter Operation			X
Check Charging/Load Management System			X
Grease Cab Pivot (if Applicable)			X
Grease all fittings			X
Operate Engine, Verify High Idle and Check for Leaks			X
Service Air Dryers		X	
Service Power Steering System		X	
Perform State Inspections (if Applicable)		X	
Drain Water out of Air Tanks	X		
Inspect and lube Compression Brake (if Applicable)			X
Inspect Engine Air Cooling System for Wear			X
Clean HVAC Drain Lines (Gravity & Venturi)		X	
Air filter element MUST be replaced when the restrictor indicator shows restriction, or annually, whichever occurs first.			

For More Comprehensive Engine Maintenance and Intervals, Go to the Engine Section of Manual and Reference the Maintenance & Operations Sheet and Engine Manual. NOTE: the Maintenance & Operations Sheet takes Precedence over the Manufacturer's Manual

For More Comprehensive Transmission Maintenance and Intervals, Refer to the Applicable Manual in the Manual Binder

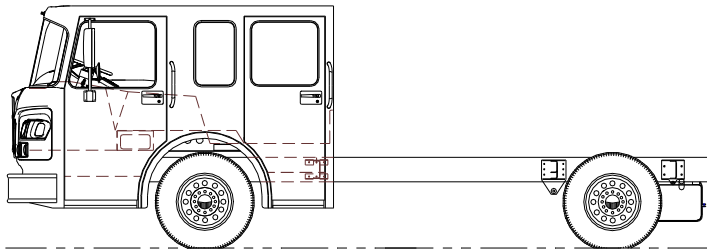
For More Comprehensive Axle Maintenance and Intervals, Refer to the Applicable Manual in the Manual Binder

For More Comprehensive Suspension Maintenance and Intervals, Refer to the Applicable Manual in the Manual Binder

For More Comprehensive SPS Maintenance and Intervals, Refer to the Applicable Manual in the Manual Binder

APPENDIX B

DRIVERS DAILY INSPECTION



DRIVERS DAILY INSPECTION

Shown below is a sample template /checklist for Driver's Daily Inspection.

DRIVER'S DAILY INSPECTION FOR APPARATUS NO. _____

LEGEND

A = Acceptable

B = Rejected (Log Problem)

C = Corrected

(Added Oil, Changed Bulb, etc.)

Date	Mileage	Engine Hours	Pump Hours	Engine Oil Level	Engine Oil Leaks	Power Steering Fluid	Coolant Level	Fan Belt Condition	Fan Belt Tension	Coolant Hose Condition	Defroster functions properly	Heater functions properly	Coolant Leaks	Transmission Oil Level	Transmission Oil Leaks	Volt Meter Reading (Running)	Defrost Fan	Wiper Blade Condition	Mirrors Adjusted	Washer Solvent Level	Brake Air Pressure	Instrument Lamps	Head Lamps	Tail Lamps	Turn Signals	Marker Lamps	Stop Lamps	Warning Lamps	Slack Adjuster Adjustment	Drain Water Out of Air Tanks	Axle Oil Leaks	Wheel Nut Inspection	Tire Inflation	Tire Condition	Water Tank Level	Drain Water From Fuel Filter	By	Shift No.			
SAMPLE																																									

Documents Incorporated by Reference

1. ISO 22241-1 NOx Reduction Agent AUS 32. Quality Requirements
2. SAE J553 Circuit Breakers
3. SAE J1888 High Current Time Lag Electric Fuses
4. SAE J2077 Miniature Blade Type Electrical Fuses